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DOE/RL-97-09
Revision 8

Radioactive Air Emissions Notice of Construction Use of a Portable Exhauster on Single-Shell Tanks During Salt Well Pumping

Office of River Protection
P.O. Box 450
Richland, Washington 99352

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Date Published
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TERMS

ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BARCT	best available radionuclide control technology
CFR	Code of Federal Regulations
Ci	curie
DST	double-shell tank
GEMS	generic effluent monitoring system
HEPA	high-efficiency particulate air
ISVS	in-situ vapor sampling
LFL	lower flammability limit
MEI	maximally exposed individual
NOC	notice of construction
PCM	periodic confirmatory measurement
SEPA	*State Environmental Policy Act of 1971*
SST	single-shell tank
TEDE	total effective dose equivalent
VSS	vapor sampling system
WAC	*Washington Administrative Code*
WDOH	Washington State Department of Health

METRIC CONVERSION CHART

Into metric units			Out of metric units		
If you know	Multiply by	To get	If you know	Multiply by	To get
Length			**Length**		
inches	25.40	millimeters	millimeters	0.0393	inches
inches	2.54	centimeters	centimeters	0.393	inches
feet	0.3048	meters	meters	3.2808	feet
yards	0.914	meters	meters	1.09	yards
miles	1.609	kilometers	kilometers	0.62	miles
Area			**Area**		
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.092	square meters	square meters	10.7639	square feet
square yards	0.836	square meters	square meters	1.20	square yards
square miles	2.59	square kilometers	square kilometers	0.39	square miles
acres	0.404	hectares	hectares	2.471	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.0352	ounces
pounds	0.453	kilograms	kilograms	2.2046	pounds
short ton	0.907	metric ton	metric ton	1.10	short ton
Volume			**Volume**		
fluid ounces	29.57	milliliters	milliliters	0.03	fluid ounces
quarts	0.95	liters	liters	1.057	quarts
gallons	3.79	liters	liters	0.26	gallons
cubic feet	0.03	cubic meters	cubic meters	35.3147	cubic feet
cubic yards	0.76456	cubic meters	cubic meters	1.308	cubic yards
Temperature			**Temperature**		
Fahrenheit	subtract 32 then multiply by 5/9ths	Celsius	Celsius	multiply by 9/5ths, then add 32	Fahrenheit
Force			**Force**		
pounds per square inch	6.895	kilopascals	kilopascals	1.4504×10^{-4}	pounds per square inch

Source: *Engineering Unit Conversions*, M. R. Lindeburg, PE., Second Ed., 1990, Professional Publications, Inc., Belmont, California.

REVISION HISTORY

Revision 8

Revision 8 reflects a modified Notice of Construction (NOC) application. This modification incorporates the following NOC Revision form approvals received to date from Washington State Department of Health (WDOH) since approval of NOC application revision 2 on WDOH AIR 98-1207 dated December 16, 1998:

Date	Approval	Revision #	Brief Description of change
6/12/99	NOC Rev Form	3	Added Tanks T-104 and T-110
7/31/99	NOC Rev Form	4	Added Tanks A-101 and U-102
6/26/00	NOC Rev Form	5	Pumping rate change
12/18/00	NOC Rev Form	6	Added U-107 Saltcake Dissolution
5/1/02	NOC Rev Form	7	Added use of RMCS exhauster

Also, this modification adds single-shell tank (SST) 241-C-103 to the saltwell pumping scope of work. Tanks where saltwell pumping has been completed have been noted in the Table 1-1 listing. A dose to the Maximally Exposed Individual has been calculated for these completed tanks and included in the Appendices. Including the completed tanks adds conservatism to the overall calculated dose and allows flexibility in the event there is a need to re-enter the tank for additional saltwell pumping. Current Hanford Site dose conversion factors (HNF-3602 Revision 1) were used in calculating the dose to the maximally exposed members of the public. Section 11.0, page 11-2, changed the maximum abated dose for pumping all tanks (identified in Table 1-1) under active ventilation at the same time from 6.76E-07 mrem/yr to 4.51E-03 mrem/yr.

Revision 7

Revision 7 was presented to the WDOH on a Hanford Facility NOC Revision Form. The WDOH approved the revision on 5/1/02. The revision was made to allow the use of a RMCS portable exhauster in addition to using a saltwell portable exhauster. The RMCS portable exhauster has a nominal flow rate of 5.7 cubic meters per minute and is below the approved bounding range for saltwell portable exhausters of 34 cubic meters per minute. There was no change in estimated or actual emissions.

Revision 6

Revision 6 was presented to the WDOH on a Hanford Facility NOC Revision Form. The WDOH approved the revision on 12/18/00. The revision was made to clarify Section 6, Process Description and Section 10, Release Rates. The clarifications describe a change in how water additions to the top of the waste will be performed in Tank 241-U-107 to determine if a portion of the waste can be dissolved and salt well pumped out the tank to a double-shell tank. There was no change in estimated or actual emissions.

Revision 5

Revision 5 was presented to the WDOH on a Hanford Facility NOC Revision Form. The WDOH approved the revision on 6/26/00. The revision was made to clarify the pumping rate in Section 6.0, Process Description to 23 to 38 liters per minute with a maximum system capability of approximately 45 liters per minute. There was no change in estimated or actual emissions.

Revision 4

Revision 4 was presented to the WDOH on a Hanford Facility NOC Revision Form. The WDOH approved the revision on 07/31/99. The revision was made to incorporate passively vented tanks 241-A-101 and 241-U-102 into the NOC. The characteristics, source terms and emissions of these two tanks are similar to and consistent with the tanks currently described in the NOC. No measurable increase in approved emissions (Hanford Facility NOC Revision form approval 6/17/99) is expected due to the addition of these two tanks.

Changes to the NOC include: adding 241-A-101 and 241-U-102 entries to Table 1-1, *Single-Shell Tanks Covered by this Notice of Construction;* Table 2-1, *Single-Shell Tank Locations*; Table 7-1, *Waste Tank Characteristics;* Appendix A, *Tank Radionuclide Inventories;* Appendix B, *Emission and Dose Calculations—Saltwell Pumping Under Passive Ventilation;* Appendix C, *Emission and dose Calculations—Saltwell Pumping Under Active Ventilation;* and Appendix D, *Emission and Dose Calculations—Water Lancing.*

The changes also include the following text modifications: Section 3.0, changed responsible manager from J. E. Kinzer to R. T. French. Section 8.0 first sentence, changed "Three types of exhausters..." to "Two types of exhausters..."; and removed the third bullet paragraph discussing the third type of exhauster. The third exhauster is no longer an option for use in conjunction with saltwell pumping. Section 11.0, page 11-2, changed the maximum abated dose for pumping all tanks identified in Table 1-1 at the same time from 6.51 E-07 mrem/yr to 6.76 E-07mrem/yr.

Revision 3

Revision 3 was presented to the WDOH on a Hanford Facility NOC Revision Form. The WDOH approved the revision on 06/17/99. The revision was made to incorporate passively vented tanks 241-T-104 and 241-T-110 into the NOC. The characteristics, source terms and emissions of these two tanks are similar to and consistent with the tanks currently described in the NOC. No measurable increase in approved emissions (AIR 98-1207) is expected due to the addition of these two tanks. 241-T-104 and 241-T-110 are not actively ventilated and do not require the use of a standby portable exhauster.

Changes to the NOC include: adding 241-T-104 and 241-T-110 entries to Table 1-1, *Single-Shell Tanks Covered by this Notice of Construction;* Table 2-1, *Single-Shell Tank Locations*; Table 7-1, *Waste Tank Characteristics;* Appendix A, *Tank Radionuclide Inventories;* Appendix B, *Emission and Dose Calculations—Saltwell Pumping Under Passive Ventilation;* Appendix C, *Emission and dose Calculations—Saltwell Pumping Under Active Ventilation;* and Appendix D, *Emission and Dose Calculations—Water Lancing*; and changing the maximum abated dose for pumping all tanks identified in Table 1-1 at the same time from 6.47 E-07 mrem/yr to 6.51 E-07mrem/yr (page 11-2, second paragraph). Changes also include removal of redundant references in the text to specific counts of tanks identified in the NOC. These changes were made to Page 1-1, Introduction; Page 11-1, sixth paragraph; Page 11-2, second paragraph.

Revision 2

Revision 2 changes were made to update the NOC the latest operational Authorization Basis and to include descriptions of activities that were previously done under routine activity status but were in question because WDOH rescinded their approval of the Routine Activity List. The changes included: requiring the use of portable ventilation during saltwell pumping only if the flammable gas levels in a tank were at 25% of the LFL; removing the SX Tanks from the NOC. These tanks are actively ventilated and were to be addressed under a separate NOC; describing and requiring a compliant monitoring system for all exhausters used on any of the tanks listed in the NOC, regardless of their offsite dose being greater or less than 0.1 mrem/yr. Adding a process description and PTE calculation for water lancing to install equipment; and adding process descriptions for adding water to a tank, flushing and removing plugs from transfer lines.

Revision 1

Revision 1 reflects WDOH concerns presented in Letter AIR 97-710, A.W. Conklin, WDOH, to J. E. Rasmussen, RL, no subject, dated July 29, 1997. Revision 1 also incorporates changes agreed to by the WDOH in the August 12, 1997 meeting. Sections 6, 9, 10, 11, and Appendix C were revised.

1.0 INTRODUCTION

This document serves as a notice of construction (NOC), pursuant to the requirements of Washington Administrative Code (WAC) 246-247-060, and as a request for approval to construct, pursuant to 40 Code of Federal Regulations (CFR) 61.07, portable exhausters for use on single-shell tanks (SSTs) during saltwell pumping. Table 1-1 lists SSTs covered by this NOC. Nine of the SSTs are noted where saltwell pumping has been completed but are included in the event additional saltwell pumping may be required. This NOC also addresses other activities that are performed in support of saltwell pumping but do not require the application of a portable exhauster. Specifically this NOC analyzes the following three activities that have the potential for emissions.

- Saltwell pumping (i.e., the actual transferring of waste from one tank to another) under nominal tank operating conditions. Nominal tank operating conditions include existing passive breathing rates.

- Saltwell pumping (the actual transferring of waste from one tank to another) with use of a portable exhauster.

- Use of a water lance on the waste to facilitate saltwell screen and saltwell jet pump installation into the waste. This activity is to be performed under nominal (existing passive breathing rates) tank operating conditions.

The use of portable exhausters represents a cost savings because one portable exhauster can be moved back and forth between SSTs as schedules for saltwell pumping dictate. A portable exhauster also could be used to simultaneously exhaust more than one SST during saltwell pumping.

The primary objective of providing active ventilation to these SSTs during saltwell pumping is to reduce the risk of postulated accidents to remain within risk guidelines. It is anticipated that saltwell pumping will release gases entrapped within the waste as the liquid level is lowered, because of less hydrostatic force keeping the gases in place. Hanford Site waste tanks must comply with the Tank Farms authorization basis (DESH 1997) that requires that the flammable gas concentration be less than 25 percent of the lower flammability limit (LFL). Safety analyses indicate that the LFL might be exceeded in some tanks during certain postulated accident scenarios. Also, the potential for electrical (pump motor, heat tracing) and mechanical (equipment installation) spark sources exist. Therefore, because of the presence of ignition sources and the potential for release of flammable gases, active ventilation might be required in some SSTs to reduce the 'time at risk' while saltwell pumping. For this reason, portable exhausters will be installed as a precautionary measure and used when flammable gas concentrations exceed 25 percent of the LFL during saltwell pumping. In addition to use of a portable exhauster for flammable gas concentrations exceeding 25 percent of the LFL, a portable exhauster may also be used in conjunction with industrial health and hygiene practices for worker comfort and safety. An exhauster may be in a standby mode at the tank or may be brought from another location if and when needed.

Table 1-1. Single-Shell Tanks Covered by this Notice of Construction.

Tank number
241-A-101
241-AX-101
241-BY-105
241-BY-106
241-C-103
241-S-101
241-S-102
241-S-103 (completed)
241-S-106 (completed)
241-S-107
241-S-109 (completed)
241-S-111
241-S-112
241-T-104 (completed)
241-T-110 (completed)
241-U-102
241-U-103 (completed)
241-U-105 (completed)
241-U-106 (completed)
241-U-107
241-U-108
241-U-109 (completed)
241-U-111

2.0 FACILITY IDENTIFICATION AND LOCATION (REQUIREMENT 1)

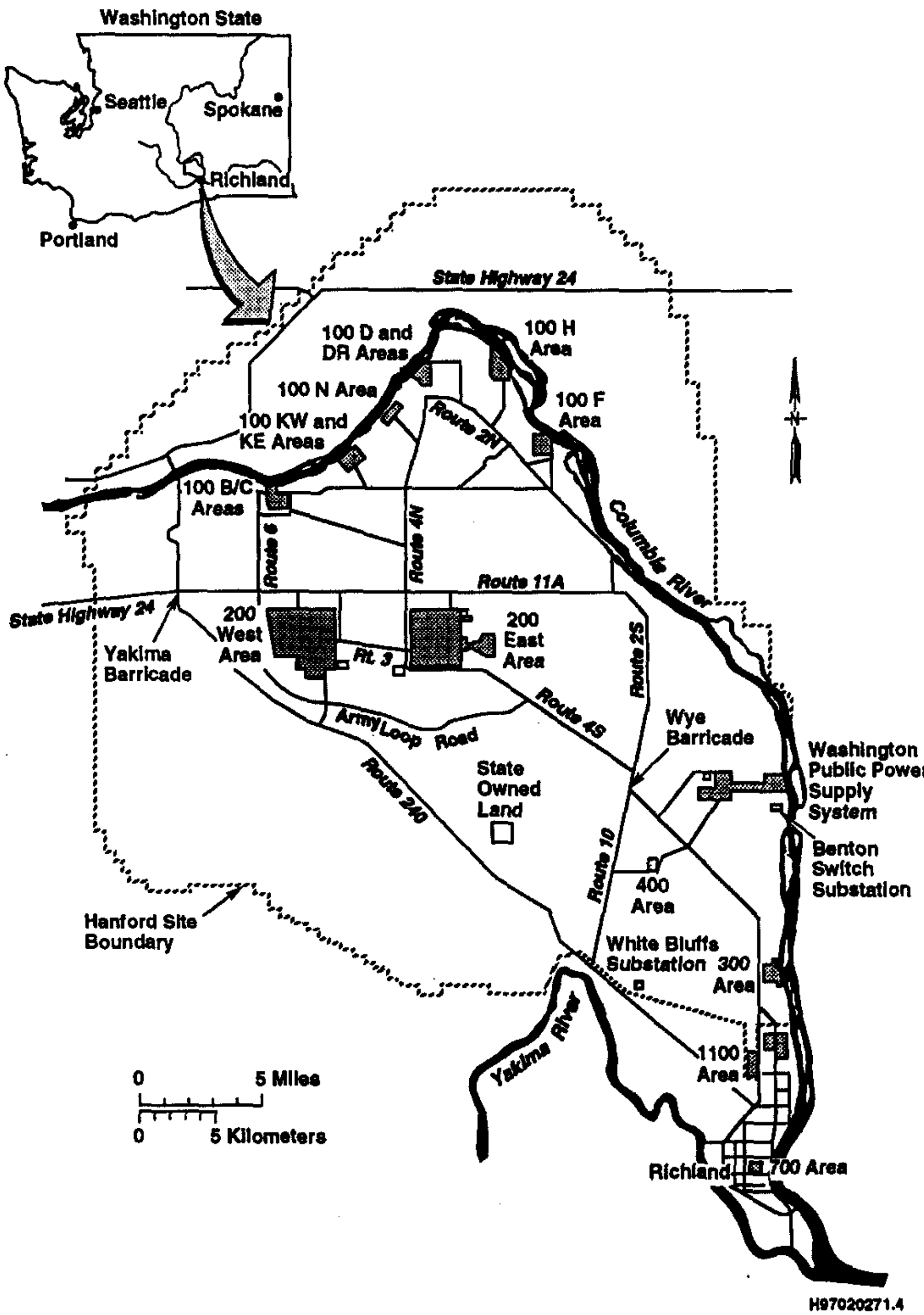
The SSTs covered in this NOC are located at:

U.S. Department of Energy, Richland Operations Office
Hanford Site
200 East and 200 West Areas
Richland, Washington 99352

Table 2-1 lists the area location and geodetic coordinates for tanks covered by this NOC.

Figure 2-1 shows the location of the 200 West and 200 East Areas within the Hanford Site. Figures 2-2, 2-3, and 2-4 show the location of each tank farm within the respective area.

Figure 2-1. Hanford Site.



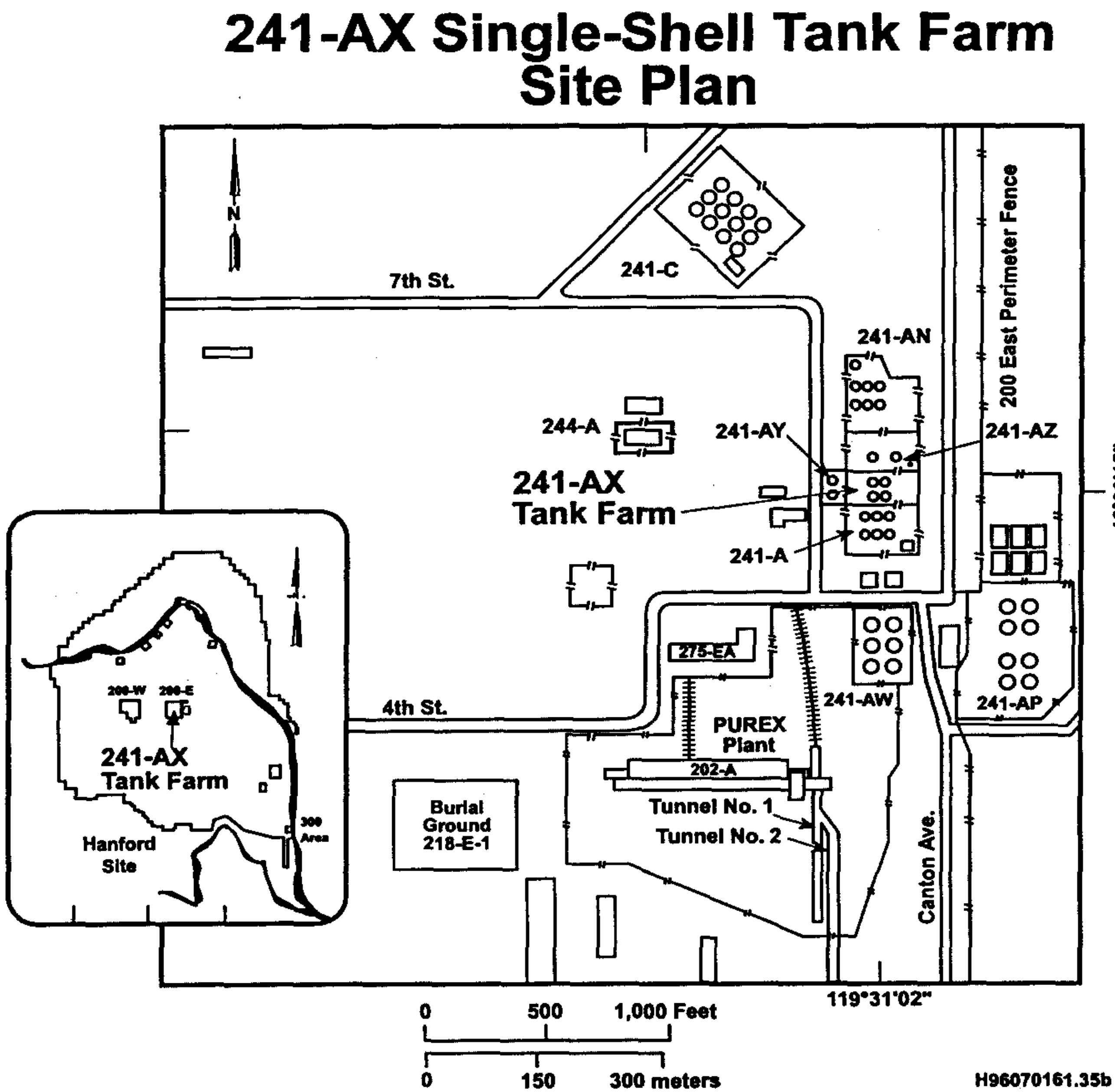


Figure 2-2. Location of the 241-AX Tank Farm Within the 200 East Area.

241-BY Single-Shell Tank Farm Site Plan

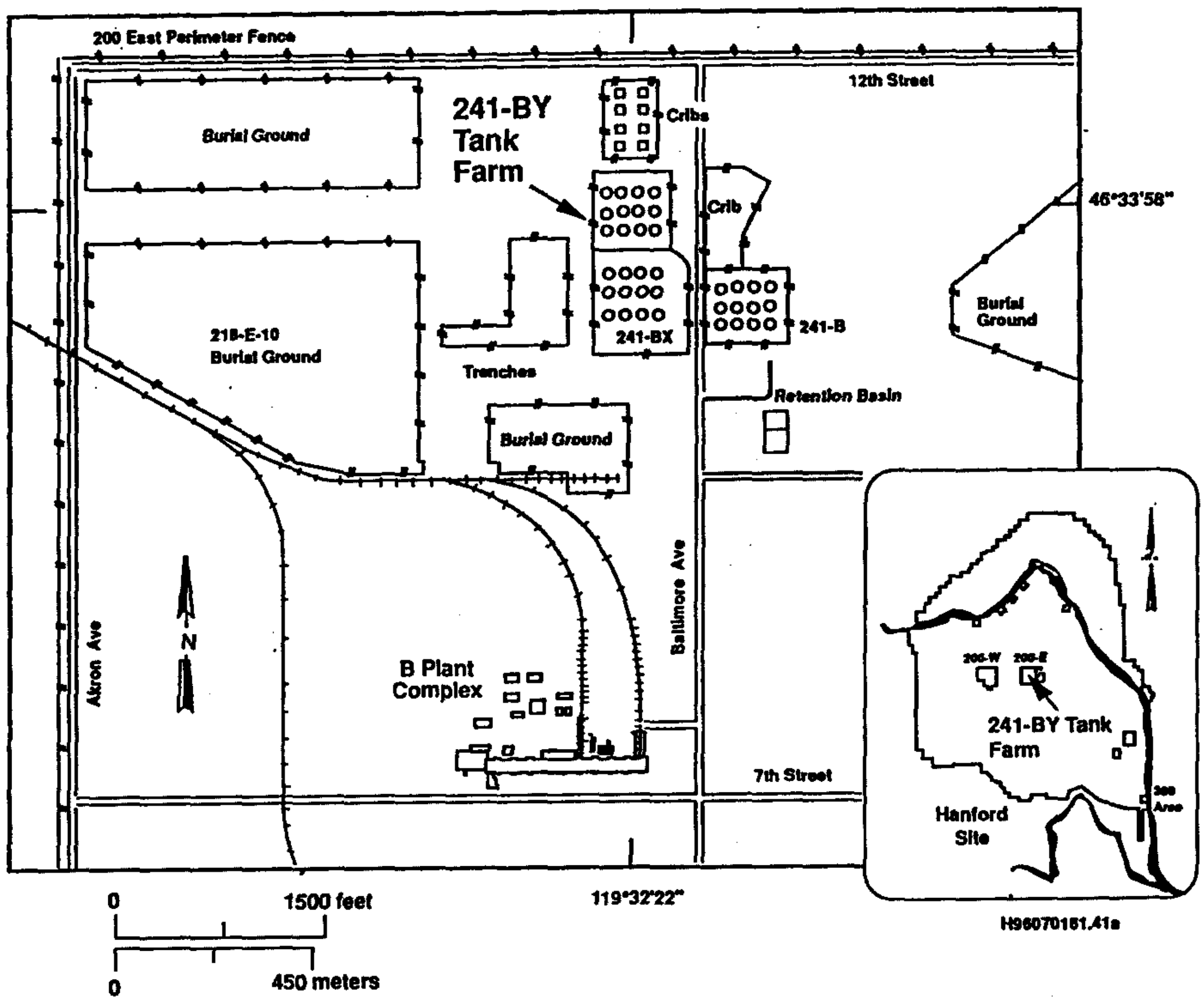


Figure 2-3. Location of the 241-BY Tank Farm Within the 200 East Area.

Figure 2-4. Location of Tank Farms Within the 200 West Area.

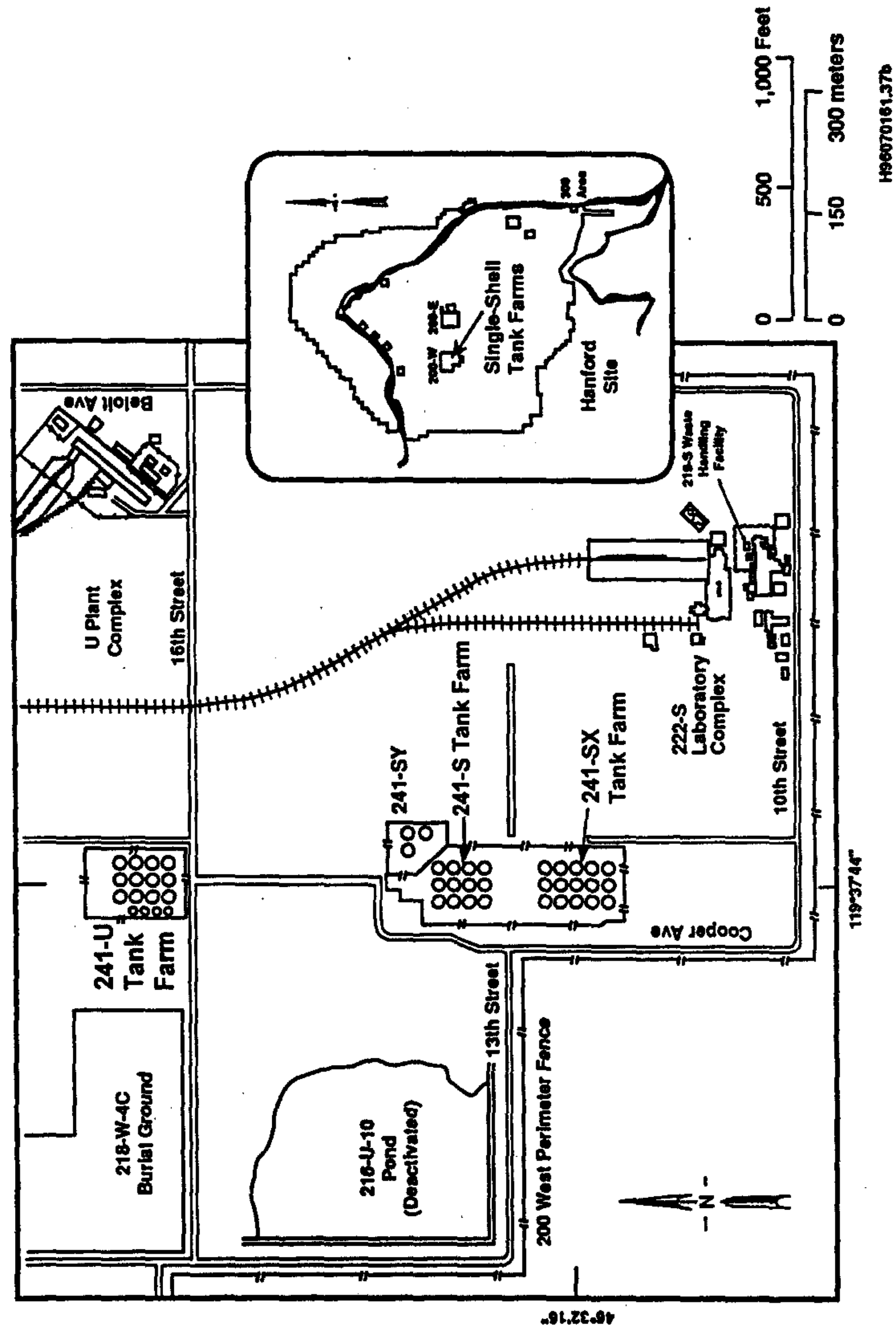


Table 2-1. Single-Shell Tank Locations.

Tank number	200 Area location	Geodetic coordinates	
		North latitude	West longitude
241-A-101	East	46E33'11"	119E31'04"
241-AX-101	East	46E33'16"	119E30'59"
241-BY-105	East	46E33'58"	119E32'22"
241-BY-106	East	46E33'60"	119E31'09"
241-C-103	East	46E33'27"	119E32'22"
241-S-101	West	46E32'24"	119E37'43"
241-S-102	West	46E32'24"	119E37'44"
241-S-103	West	46E32'24"	119E37'46"
241-S-106	West	46E32'23"	119E37'46"
241-S-107	West	46E32'22"	119E37'43"
241-S-109	West	46E32'22"	119E37'46"
241-S-111	West	46E32'21"	119E37'44"
241-S-112	West	46E32'21"	119E37'46"
241-T-104	West	46°33'37"	119°37'42"
241-T-110	West	46°33'35"	119°37'42"
241-U-102	West	46E32'44"	119E37'44"
241-U-103	West	46E32'44"	119E37'45"
241-U-105	West	46E32'43"	119E37'44"
241-U-106	West	46E32'43"	119E37'45"
241-U-107	West	46E32'42"	119E37'42"
241-U-108	West	46E32'42"	119E37'44"
241-U-109	West	46E32'42"	119E37'45"
241-U-111	West	46E32'41"	119E37'44"

3.0 RESPONSIBLE MANAGER (REQUIREMENT 2)

The responsible manager's name and address are as follows:

Mr. R. J. Schepens, Manager
U.S. Department of Energy, Office of River Protection
P.O. Box 450
Richland, Washington 99352
(509) 376-6677

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4.0 TYPE OF PROPOSED ACTION (REQUIREMENT 3)

The proposed action represents an insignificant modification to an existing emission unit for all SSTs listed in Table 1-1, except for SST 241-C-103, 241-S-101, 102, 103, 106, 107, 109, 111, and 112. The proposed action for these nine tanks represents a significant modification in accordance with WAC 246-247-030 when being saltwell pumped with active ventilation. All SSTs discussed in this NOC are passively ventilated. The proposed modification is to install a portable exhauster on SSTs during saltwell pumping if and when needed. As stated in Section 1.0, an exhauster may be in a standby mode at the tank or may be brought from another location. The exhausters will be used when flammable gas levels exceed 25 percent of the LFL or used in conjunction with industrial health and hygiene practices for worker comfort and safety. This NOC also addresses other activities that are performed in support of saltwell pumping but do not require the application of a portable exhauster.

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5.0 STATE ENVIRONMENTAL POLICY ACT (REQUIREMENT 4)

The proposed action is categorically exempt from the requirements of the *State Environmental Policy Act of 1971* (SEPA) under WAC 197-11, "SEPA Rules," Section WAC 197-11-845, "Department of Social and Health Services."

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6.0 PROCESS DESCRIPTION (REQUIREMENTS 5 AND 7)

Saltwell pumping is a method used to interim stabilize SSTs. Interim stabilization is commenced once a saltwell screen has been installed with its respective jet pump. Saltwell pumping removes the gravity drainable liquid from the interstitial space between the solids that drain to the saltwell screen. Saltwell pumping uses pre-established routes to transfer the liquid either directly to a double-shell tank (DST) or to a staging double-contained receiver tank and subsequently to a DST.

Before transferring waste, several activities are performed that include:

- Verifying the waste chemistry to ensure that the waste to be transferred is compatible with the receiving tank waste
- Performing criticality safety analyses to ensure that stored waste will remain in a subcritical state
- Verifying equipment operability
- Developing a baseline material balance for both sending and receiving tanks. (The material balance also is reviewed periodically during the transfer to provide early leak detection and to avoid filling tanks above safe levels).

Saltwell pumping the drainable liquid waste includes the following activities:

- Initial planning including waste compatibility studies, criticality analysis, equipment specification, and tank material balance determinations as discussed previously
- Installation of saltwell screen
- Jet pump assembly installation
- Transferring the liquid waste (via saltwell pumping)
- Occasionally, additions of limited amounts of water are made to prevent plugging of the saltwell screen and transfer line
- Flushing and cleaning plugs from transfer lines.

The jet pump intake is located at the bottom of the saltwell screen and is suspended by supply and return lines connected to a centrifugal pump unit located above the tank in the pump pit. The motive power for the pumping process is provided by the centrifugal pump unit. The motor and centrifugal pump assembly are hermetically sealed and thus designed for pumping hazardous material. Pump pits are equipped with leak detectors to help detect any possible waste leakage. Saltwell pumping is accomplished at very slow rates, approximately 23 to 38 liters per minute with a maximum system capability of approximately 45 liters per minute. Slow collection of liquid in the well often requires pumping at less than 4 liters per minute. After saltwell pumping is complete, the jet pump will remain in the pit and the screen will remain in the tank for the foreseeable future.

A detailed description of the saltwell pumping process and equipment is presented in HNF-DS-WM-BIO-001, "Tank Waste Remediation System Basis For Interim Operation", which is only referenced for additional information.

6.1 INSTALLATION OF THE SALTWELL SCREEN

A saltwell screen is a mechanical device, approximately 11 inches in diameter, which normally extends from the top of the waste to within 2 inches of the tank bottom. The 400-mesh size holes in the screen allow liquid waste to pass through the screen (enter the pump cavity) while preventing solid waste from migrating to the jet pump.

Water lancing of the waste could be necessary to facilitate installation of the saltwell screen. Water lancing normally uses up to 1,895 liters of hot (93 EC) water at low pressure (1,034 kilopascals) to penetrate the crust on the waste and create a circular entry area large enough for the screen. The water lance is a long pipe, up to 7.62 centimeters in diameter with a nozzle at the end that is lowered into the tank, through a riser, via a mobile crane attached to a truck. A hose from a portable water tank is connected to the other end of the water lance. The flushing water to the water lance is turned on just before the lance reaches the waste surface to minimize water additions to the tank. The water lance withdrawal steps are essentially the reverse of the insertion sequence. The use of this water lance requires that the lance be raised and lowered into the waste multiple times so that a large enough hole can be formed in the waste to accommodate the screen. Alternately, a newer water lance design to accomplish the same task could be used. The new lance has an 28-centimeter diameter and multiple nozzles on the bottom to facilitate waste penetration, and is designed to create a hole in the waste large enough to accommodate the saltwell screen with one insertion of the lance into the waste. This design requires less water volume and operates at higher pressure (20,685 kilopascals). During removal of a lance from a tank, portable water wands are used to wash waste residue from the outside of the water lance until radiation readings are within specified limits. The water lance is placed in a protective bag during the removal process.

The saltwell screen is connected to a source of flushing water by a hose at the top of the screen. The screen also is rigged for lift by a mobile crane. The saltwell screen assembly is lowered slowly into the pit and riser until the screen flange rests on the riser opening. The riser is capped until jet pump assembly is scheduled for installation.

The entire operation of installing a saltwell screen, including water lancing, generally takes less than 8 hours. Radionuclide control is maintained mechanically by use of a spray ring that rests on top of the riser and allows the water lance to telescope through the ring. Although there is no physical contact between the lance outside diameter and the spray ring inside diameter, control of radionuclides is achieved by spraying water over this interface as the lance is lowered, which also helps to minimize the potential for sparking as well as controlling radionuclides. Additional radionuclide control is achieved by lowering the lance at a maximum speed of approximately 1 foot per second. Also, this operation is performed in accordance with formal procedures and radiation surveys during the actual work activity to ensure containment of radionuclides. Pre-job and post-job surveys are performed to verify containment. The actual water lancing time usually takes approximately 30 minutes to 2 hours.

As noted in Section 11.0, the analysis assumes water lancing operations will be performed under passive tank breathing rates for a period not to exceed 72 hours of actual water lancing. The 72-hour period will be controlled administratively.

6.2 JET PUMP INSTALLATION

Water lancing of the salt screen and waste inside the saltwell screen might be necessary to facilitate jet pump assembly installation within the screen. If water lancing is required, this will be performed as discussed previously. The saltwell pump assembly is brought to the tank farm in several pieces, and is assembled and tested before installation. Following preoperational checks of the complete jet pump assembly, the pump assembly will be raised to a vertical position by a mobile crane and slowly lowered into the saltwell screen until the pump support plate rests on top of the saltwell screen flange. A small amount of water is passed through the dip tubes while the pump is lowered into the screen to prevent plugging the dip tubes. The dip tubes are half-inch carbon steel tubes used as instrumentation to monitor waste level and specific gravity. Similarly, small amounts of water also are passed through the dilution tube to prevent plugging. The dilution tube allows water to be added to the tank to prevent plugging of the screen (discussed in Section 6.3). In some cases, instrumentation lines are installed as part of the saltwell pump assembly; in other cases, instrumentation lines are installed after the assembly is installed.

The entire operation of installing a jet pump assembly generally takes less than 4 hours.

6.3 TRANSFERRING THE WASTE (SALTWELL PUMPING)

The discharge of the jet pump assembly will be connected to the tank farm transfer system by use of a flexible jumper assembly located within the pit. The pump pits are equipped with leak detectors to help detect liquid waste leaks. If leaking is detected, pumping automatically is stopped. Occasionally water will be added to the tank via a pipe from an outside storage tank to prevent plugging of or to remove plugs from the saltwell screen and pump equipment. The water will be piped from a storage tank through a metering system at a rate of 280 liters per minute or less. Entry into the tank is made through the pump pit via an existing port on the pit cover and into the saltwell screen.

The concrete or steel cover block is reinstalled before starting the pumping operation. The cover contains penetrations for the various valve handles, electric cables, and air, water, and sample lines. Following testing of the equipment, saltwell pumping begins and could continue for several months to several years depending on the initial volume of waste to be pumped and the rate liquid drains to the saltwell. Periodic surveillances and operational checks will occur during saltwell pumping. A portable exhauster will be available for saltwell pumping if and when needed and will operate in the event that flammable gas levels exceed 25 percent of the LFL during the pumping campaign or used in conjunction with industrial health and hygiene practices for worker comfort and safety. The portable exhauster will be isolated from the tank by an isolation valve when the exhauster is not in use.

6.4 FLUSHING AND CLEANING PLUGS FROM TRANSFER LINES

The waste transfer operations involve the pumping of liquid waste that contains dissolved solids. These solids can precipitate out of solution anywhere in the transfer path and cause blockage. If blockage is detected in the system, flushing the affected components with hot water will be necessary. Other techniques to free blockages could include pressurization, and the use of heat tracing, temporary jumpers, and hydraulic scouring. The hot water will be introduced to the system to be flushed through a pressure manifold by piping connected directly to the jet pump, or bypassing the jet pump and connected directly to a jumper or nozzle. All piping connections are designed to be leak tight and the pit cover block will be installed before pressurization. If pressurization beyond that obtained from the tank farms water system or supply truck (i.e., approximately 1,034 kilopascals) is necessary to remove blockage, an engineering evaluation will be performed to determine the maximum allowable pressure for operation. At a minimum, flushing will be performed when the system is shut down for any length of time and at the end of a saltwell pumping campaign.

As in the case of water lancing, flushing of the transfer lines and/or plug removal will be performed in accordance with operating procedures and radiation surveys during the actual work activity to ensure containment of radionuclides. Pre-job and post-job surveys will be performed to verify containment. This activity has been conducted previously without incident during and after waste transfers in actively and passively ventilated SSTs and actively ventilated DSTs.

Flushing of transfer lines could be performed with or without an operating portable exhauster.

6.5 SALT CAKE DISSOLUTION

At Tank 241-U-107, water additions may also be made to the top of the salt cake to determine how much of the salt cake can be dissolved and removed during saltwell pumping. After the supernate is saltwell pumped from this tank, a low flow of water (approximately 7 to 16 liters per minute) is planned to be sprinkled on top of a portion of the salt cake's surface to enhance dissolution. The water application system will consist of water supply tubing inserted through an existing riser and one or more low volume sprinklers that can apply water of varying temperatures. The water will be provided by the tank farms water system or supply truck.

Application of dissolution water is expected to last for approximately three months. Dissolution data and video obtained at Tank 241-U-107 will be utilized for planning future salt cake dissolution efforts. Salt cake dissolution activities at Tank 241-U-107 could be conducted with or without an operating portable exhauster.

As discussed in Section 1.0 portable exhausters will be installed if and when needed on SSTs during saltwell pumping as a precautionary measure and will be used when flammable gas levels exceed 25 percent of the LFL or used in conjunction with industrial health and hygiene practices for worker comfort and safety.

7.0 ANNUAL POSSESSION QUANTITY AND PHYSICAL FORM (REQUIREMENTS 8, 10, 11, AND 12)

A task was initiated in 1996 to establish a standard inventory for chemicals and radionuclides in the tank waste. The goal was to resolve differences among the many reported inventory values and to provide a consistent, technically defensible and reproducible, inventory basis for all waste management and disposal activities. Typical data sources reviewed included sample analyses, process flow sheets, waste transaction records, computer modeling, reactor fuel data, and essential material records. The reconciliation process resulted in inventories for 46 radionuclides and 30 nonradioactive components. The radionuclide inventories for each tank covered in this NOC were obtained through this reconciliation process and were obtained from the Tank Waste Information Network System (TWINS) database available on the Internet. The tank radionuclide inventories are presented in Appendix A.

The physical form of each radionuclide listed in Appendix A is a particulate solid, except for tritium and carbon-14 that are liquids.

The annual possession quantity (APQ) of radionuclides based on SST tank radionuclide contents was not used as the source term for calculating emissions. Instead, the source term used as a basis for this NOC is the radionuclide particulates present in the vapor space of each tank expressed in terms of total alpha, total beta, and cesium-137 as shown in Table 7-1. All the radionuclides contributing 10 percent or more of the potential offsite exposure are in particulate form. Emission estimates are based on the vapor space source term for each tank and are presented in Sections 10.0 and 11.0.

Table 7-1. Tank Vapor Space Data.[a] (2 sheets)

Tank number	Date in service	Date inactivated	Total Alpha (pCi/L)	Total Beta (pCi/L)	Cs-137 (pCi/L)	Tank integrity[b]
241-A-101	1956	1980	0.18	0.93	<0.1	Sound
241-AX-101	1965	1980	0.24	1.08	<0.1	Sound
241-BY-105	1951	1974	<0.002	0.016	<0.1	Assumed leaker
241-BY-106	1953	1977	0.01	0.04	<0.1	Assumed leaker
241-C-103	1946	1979	6.4	10.1	<0.1	Sound
241-S-101	1953	1980	<0.157	<1.67	<26.9	Sound
241-S-102	1953	1980	0.59	2.96	3.89	Sound
241-S-103	1953	1977	0.86	6.17	<24.8	Sound
241-S-106	1953	1976	<0.609	<2.06	<18	Sound
241-S-107	1952	1980	2.91	2.63	<31.8	Sound
241-S-109	1952	1982	2.69	7.16	<26.9	Sound
241-S-111	1952	1978	0.52	0.82	<0.1	Sound
241-S-112	1952	1976	12	13.2	<0.1	Sound
241-T-104	1946	1976	0.07	0.32	<0.1	Sound
241-T-110	1944	1976	0.06	0.09	<0.1	Sound

Table 7-1. Tank Vapor Space Data.[a] (2 sheets)

Tank number	Date in service	Date inactivated	Total Alpha (pCi/L)	Total Beta (pCi/L)	Cs-137 (pCi/L)	Tank integrity[b]
241-U-102	1946	1976	0.07	0.18	<0.04	Sound
241-U-103	1947	1978	0.21	0.01	<0.1	Sound
241-U-105	1947	1979	0.02	0.09	<0.1	Sound
241-U-106	1948	1977	0.15	0.72	<0.1	Sound
241-U-107	1948	1980	0.004	0.06	<0.1	Sound
241-U-108	1949	1979	0.03	0.16	<0.1	Sound
241-U-109	1949	1980	0.22	0.31	<0.1	Sound
241-U-111	1947	1980	0.05	0.21	<0.1	Sound

[a]D. Sklarew (PNL) to G. Wells (CHG), August 27, 2001.
[b]Reference: HNF-EP-0182,Rev 165.

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8.0 CONTROL SYSTEM (REQUIREMENT 6)

Three types of exhausters will be available for use during salt well pumping. Two exhausters will be portable exhausters rated at 17 cubic meters per minute and 34 cubic meters per minute. The third exhauster is a rotary mode core sampling exhauster rated at 5.7 cubic meters per minute (approximately 200 cfm).

Saltwell portable exhauster design is essentially identical with two notable exceptions: the absence of a demister in the 17-cubic meter per minute design and high-efficiency particulate air (HEPA) filter design, depending on flow capacity. The 17-cubic meter per minute exhauster and the 34-cubic meter per minute exhauster have the same HEPA filter size but the thickness of the HEPA filter differs. Saltwell portable exhausters will not be operated at a cfm level that exceeds the HEPA cfm rating.

The major system components of a portable exhauster are listed as follows. Components are similar between the saltwell portable exhausters and the RMCS exhausters. Both the saltwell portable exhausters and the RMCS exhausters have testable HEPA sections. The only noticeable difference is there is only one HEPA test section on the RMCS exhauster but the capability does exist to individually test each HEPA filter. Both the saltwell and RMCS exhausters have the same required abatement control technology consisting of a prefilter, heater, two HEPAs, and fan. The abatement technology for the emission unit will undergo routine maintenance, repair, and replacement-in-kind as defined in WAC 246-247-030(22) and (23)(a) and (b).

- Ductwork
- Isolation valves
- Glycol (or similar) heaters and associated components
- Demister (34-cubic meter per minute design only)
- 1 prefilter and housing
- 2 HEPA filter test sections
- 2 HEPA filter and filter housing
- 1 exhaust fan
- Stack
- Condensate drain and seal pot system
- Insulation
- Instrumentation and controls
- Electrical system
- Support skid.

When a portable exhauster is required for saltwell pumping or the performance of supporting activities, the exhauster will draw warm moist air from the tank, heat and filter the air, and release the air to the environment. During active ventilation, fresh air, drawn into the tank vapor space through a breather filter, will dilute and disperse any flammable gases present. In the event a portable exhauster is installed at a tank but is not running and the tank is being pumped under passive ventilation, the portable exhauster will be valved off and air will enter or exit the tank through the breather filter, depending on tank internal pressure relative to atmospheric pressure. Each breather filter will consist of a housing that contains a HEPA filter, an outlet screen, and a small seal loop. During passive ventilation, an isolation valve normally will be open to allow air flow between the tank vapor space and the outside atmosphere through the filter. Air flowing to and from the tank will pass horizontally through the filter and vertically through the downward-facing exit weather hood. Seal loops, installed in the exhaust lines, are designed as a safety feature to prevent a highly unlikely accident in which an over pressurization occurs when the HEPA filter is isolated for occasional (infrequent) maintenance. Figure 8-1 shows breather filter configuration on a typical SST. Figure 8-2 shows components of a typical breather filter.

Air from the tank will be heated to reduce the relative humidity before passing through the prefilter. The air will pass through the prefilter, two HEPA filters in series, a fan and discharge through a stack. The stack will contain a section that allows for the installation of air flow measuring and temporary sampling devices. Any moisture that might accumulate inside the exhauster will be collected in a drain system, routed to a seal pot, and returned to the tank.

All components and materials that are in direct contact with the air stream will be designed in accordance with the applicable authorization basis requirements (HNF-DS-WM-BIO-001) for flammable gas issues.

Flexible or rigid ductwork (depending on the design at each tank farm) will be used to connect the exhauster inlet to the tank riser. Precautionary measures to protect the air pathway during connection of the ductwork to the tank riser will include installation of an isolation valve in the riser to minimize the time tank contents are exposed to the air, and will take into account abrasion, leakage, tear strength, tensile strength, air stream temperature, and outdoor exposure conditions. All flexible ductwork will be bonded to ensure electrical conductivity.

The prefilter will increase the life of the HEPA filters by trapping the larger airborne particles allowing for a more economical operating system. As low as reasonably achievable (ALARA) concepts will be applied to allow less frequent change out of the HEPA filters, thereby reducing exposure of personnel to radiation sources.

The HEPA filters will meet the requirements of ASME AG-1, Section FC and will be tested annually to requirements of ASME N510. The HEPA filters will be nuclear grade throw-away extend-media dry-type in a rigid frame having minimum particle collection efficiency of 99.95 percent for 0.3 micrometer median diameter, thermally-generated dioctylphthalate particles or other specified challenge aerosols. Pressure drop of a clean filter will be a maximum of 1 inch water gauge at rated flow. The frame will be corrosion resistant for the air stream design conditions. Each filter will have a gelatinous seal gasket material that will be on the air inlet gasket surface.

The HEPA filter housing will provide a sealed barrier for the confinement of airborne radionuclides and will serve to encapsulate and hold the HEPA filter. The filter housing will provide for the attachment of pressure differential measurement components. Each filter housing will meet the applicable sections of ASME N509 and the test requirements of ASME N510. The filter housings will be leak tested using the pressure decay method in accordance with ASME N510. Leakage will not exceed 0.3 percent of the housing volume per hour.

The test sections will provide a means for in place testing of the HEPA filters. Testing will confirm that any airborne radionuclide particles are captured to the level of efficiency of the installed HEPA filter. One test section will be placed downstream of the prefilter section and upstream of the first HEPA filter section. The second test section will be placed between the first stage HEPA filter housing and the second stage HEPA filter housing. As noted earlier on the RMCS exhauster, there is only one HEPA test section between the first stage HEPA and the second stage HEPA but the capability does exist to individually test each HEPA filter.

The exhaust fan will be constructed of non-sparking materials and will meet AMCA Standard 99-0401-86 and be Type A construction. The fan will be a centrifugal type and be statically and dynamically balanced as an assembly.

The exhaust stack houses the air velocity probe (for measurement of stack velocity) and the air sampling probe. Flexible ductwork will be used to connect the fan outlet to the stack.

Stack identification will be in accordance with the Hanford Site Air Operating Permit and will be reported in the notification of pre-operational testing per WAC 246-247-060 paragraph 4, and the notice of anticipated startup date provided in accordance with 40 CFR 62.09.

Figures 8-3 and 8-4 show plan and elevational views of a portable exhausters' components. Figure 8-3 shows the general arrangement of SST components including HEPA inlet breathing filters. The RMCS exhauster general arrangement is similar except there is only one HEPA test section between the first stage HEPA and the second stage HEPA.

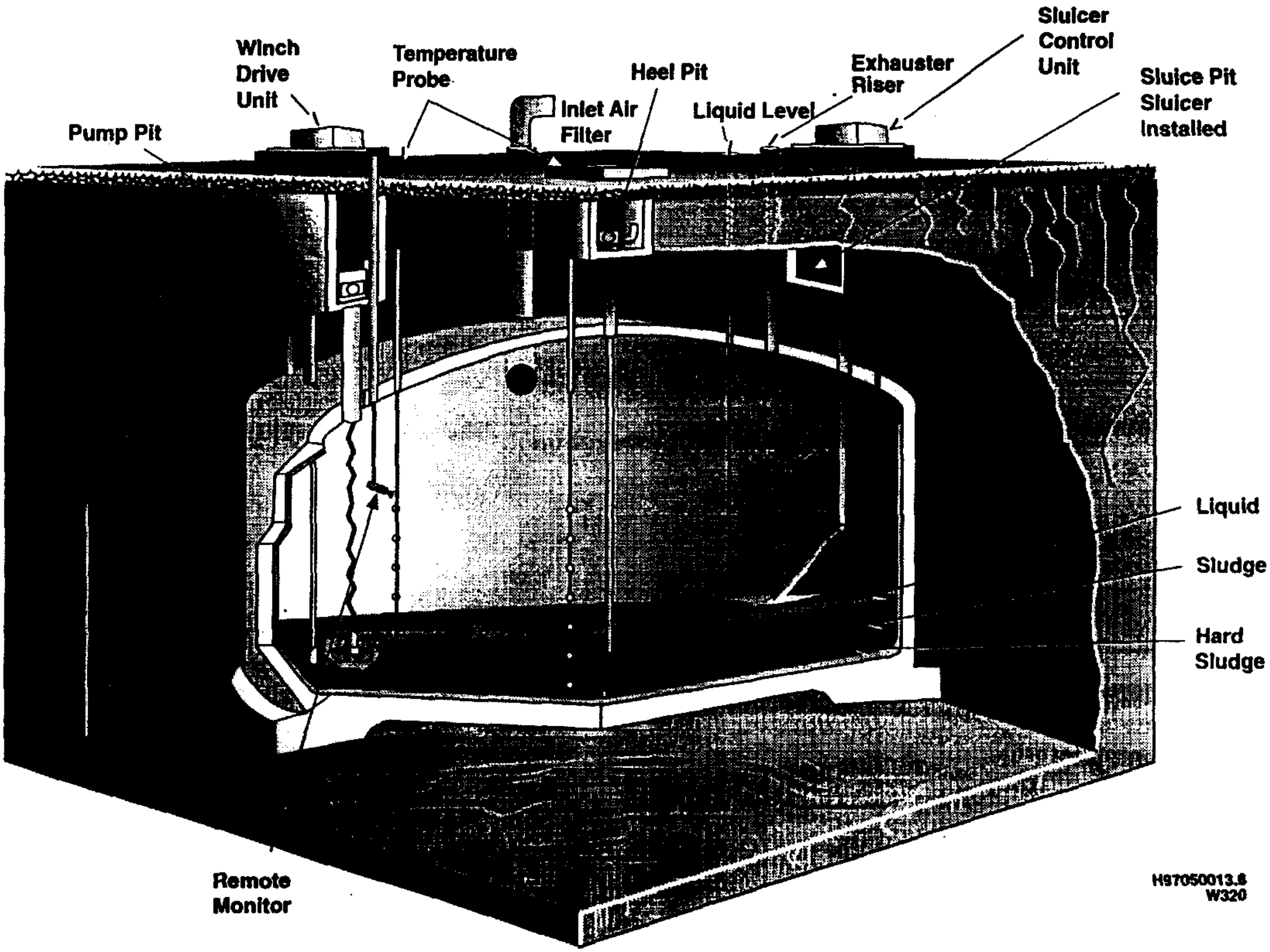
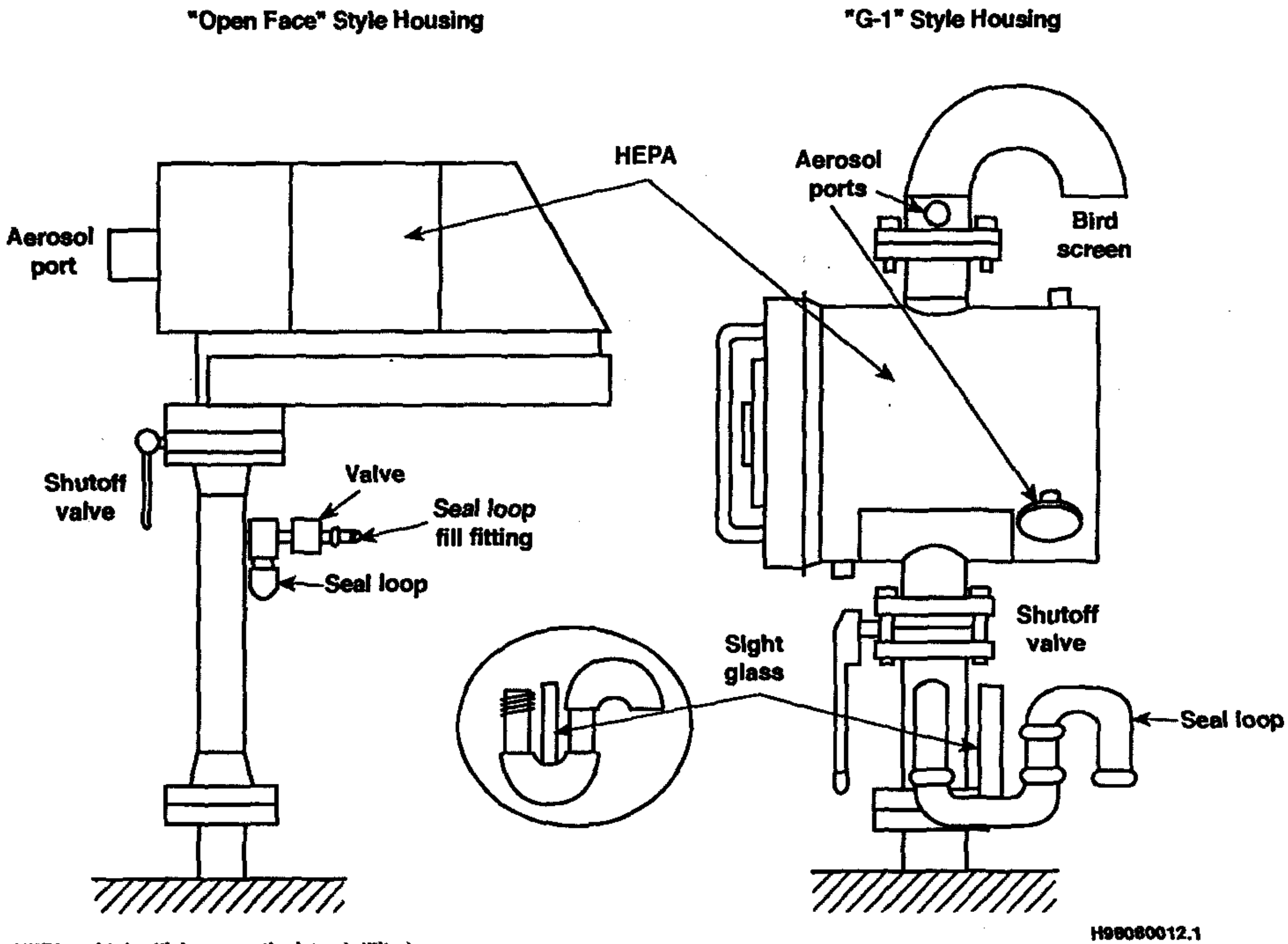


Figure 8-1. Single-Shell Tank Showing Air Inlet filter (breather filter).



HEPA = high-efficiency particulate air (filter).

Figure 8-2. Single-Shell Tank Breather Filter Components.

Figure 8-3. Ventilation Control System Diagram--Plan View.

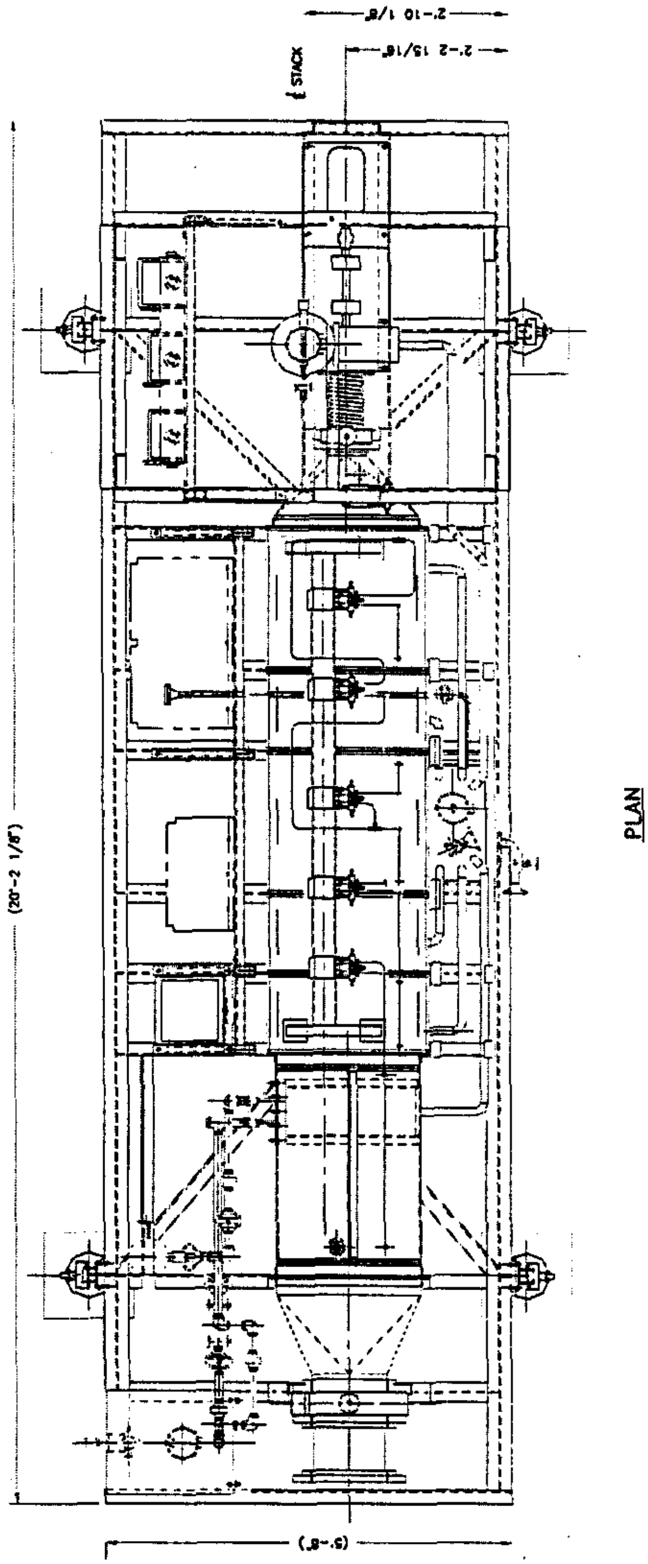
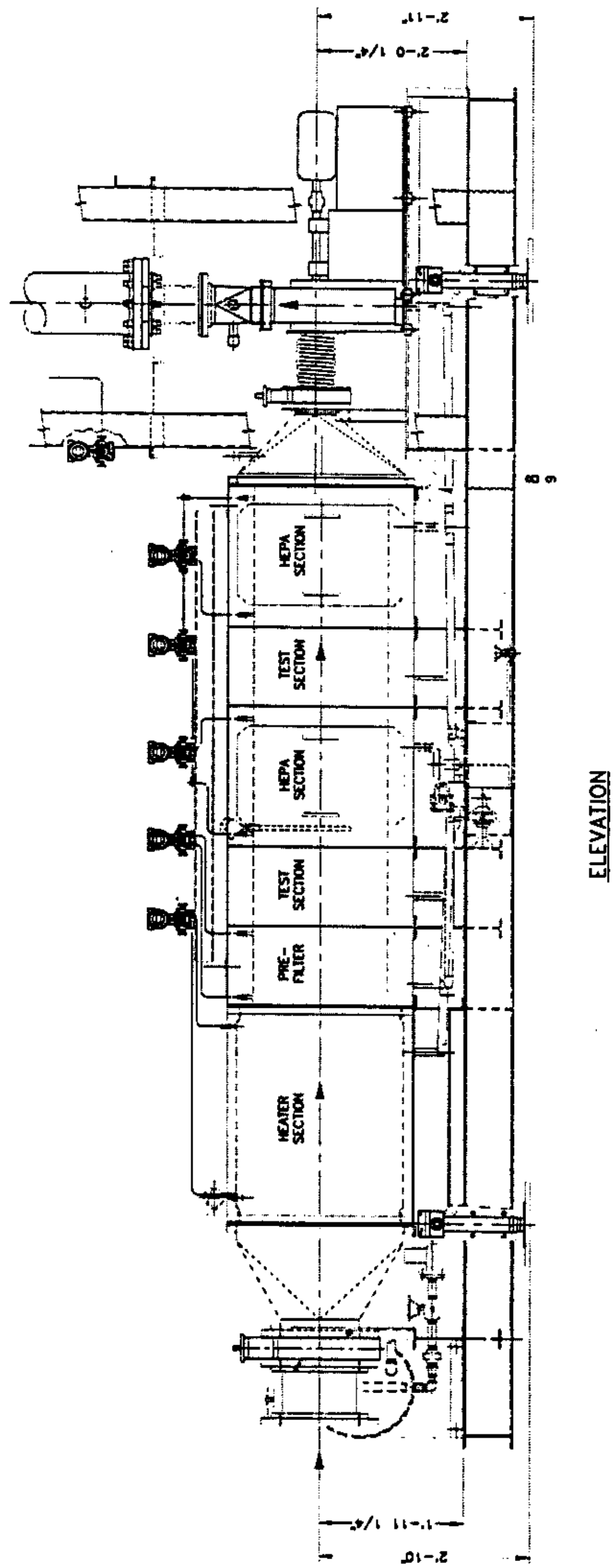


Figure 8-4. Ventilation Control System Diagram--Elevation View.



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9.0 MONITORING SYSTEM (REQUIREMENT 9)

The monitoring system used on all portable exhausters employed in the saltwell pumping program will meet the regulatory compliance requirements specified in 40 CFR 61, Subpart H and its referenced requirements, for all tanks covered by this NOC regardless of whether each tank (stack) is designated as major or minor.

The system, identified as the generic effluent monitoring system (GEMS), has been subject to extensive testing (PNNL-11701) and shown to meet all applicable regulatory criteria for air sampling at nuclear facilities. The performance criteria addressed both the suitability of the air sampling probe location and the transport of the sample to the collection devices.

The system includes a stack section containing the sample probe and another stack section containing the airflow, temperature, and humidity sensors. The GEMS design features a probe with a single shrouded sampling nozzle, a short sample delivery line, and a sample collection system. The collection system includes a filter holder to collect the record sample and an in-line beta continuous air monitor for monitoring beta radiation-emitting particles. The record sampler will operate continuously during exhauster operation. The beta sensor could operate continuously in accordance with the authorization basis (HNF-SD-WM-BIO-001), but there is no environmental regulatory requirement to do so. An interlock is installed to shut down the exhaust fan if the beta sensor detects elevated emissions. Both the record sampler systems and the beta sensor calibration will be current prior to exhauster operation.

Figures 9-1 and 9-2 show details of the stack and shrouded nozzle, respectively.

On those tanks saltwell pumped in the passive ventilation mode, the current requirement for periodic confirmatory measurement (PCM), as specified in the Hanford Site Air Operating Permit, Number 00-05-006 shall be performed. PCM will be conducted annually by verifying the levels of smearable contamination on the inside surface of the ducting downstream of the HEPA filter or on the outside of the screen covering the outlet of the vent, should one exist. Confirmation of levels below 10,000 disintegrations per minute per 100 square centimeters beta/gamma and 200 disintegrations per minute per 100 square centimeters alpha will be used to verify low emissions. Detected levels above these thresholds would result in further investigation and reporting if the cause was due to an airborne emission. The radiological survey reports will become the record for the PCM.

Figure 9-1. Components of Saltwell Exhauster Stack.

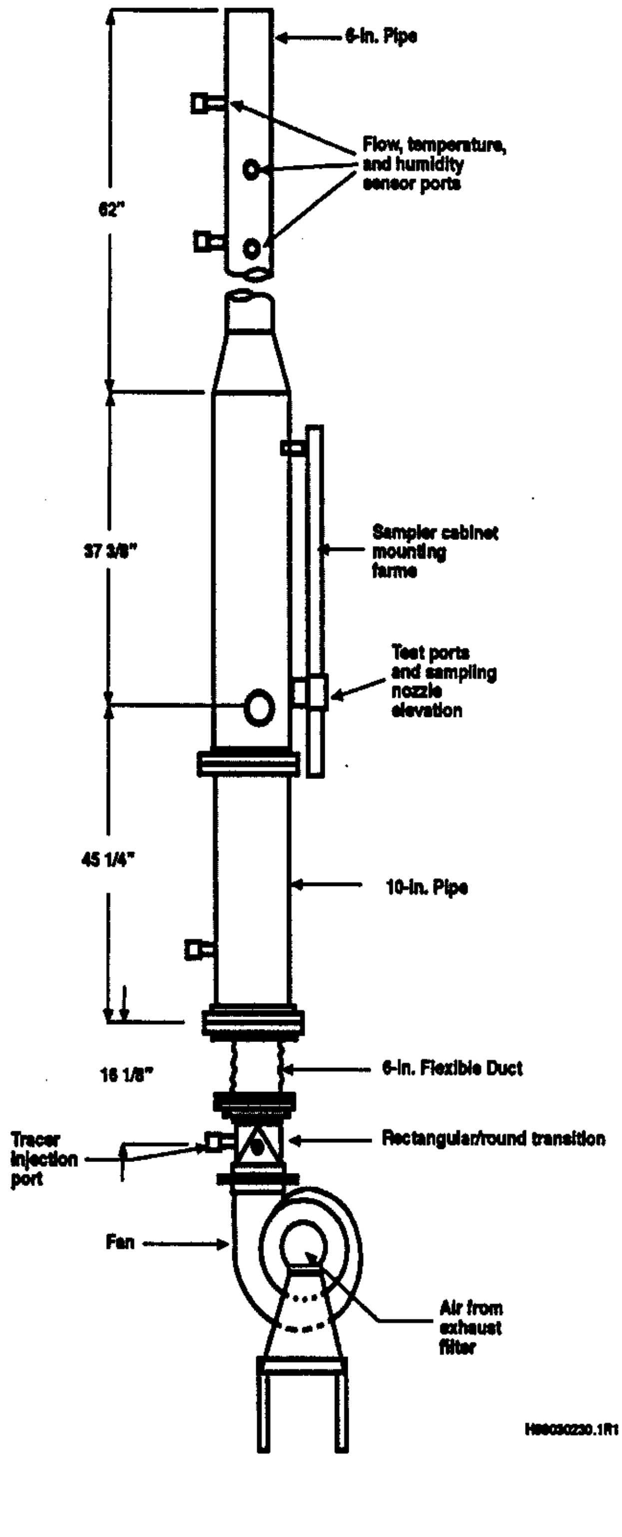
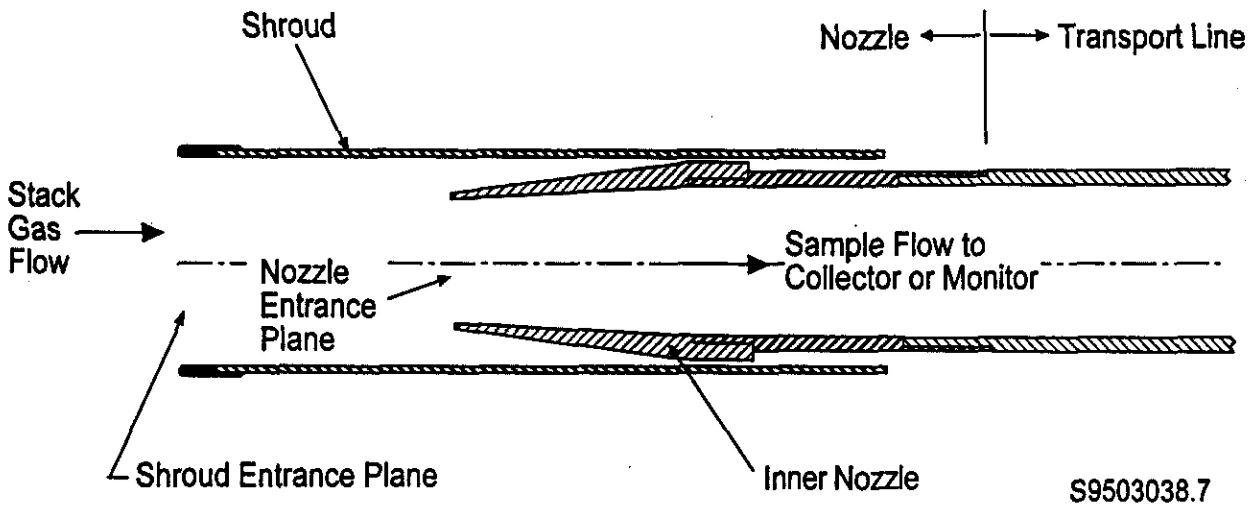


Figure 9-2. Configuration of Shrouded Nozzle.



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10.0 RELEASE RATES (REQUIREMENT 13)

As discussed in Section 1.0, portable exhausters will be installed on SSTs if and when needed during saltwell pumping as a precautionary measure for use when flammable gas concentrations exceed 25 percent of the LFL or may also be used in conjunction with industrial health and hygiene practices for worker comfort and safety. If the portable exhauster is operated for either a flammable gas issue or for an industrial health issue, emissions will be monitored and reported. This NOC also addresses other activities that will be performed in support of saltwell pumping, but do not require the application of a portable exhauster. In the past, these support activities have been considered routine in accordance with WAC 246-247. This section evaluates the potential for emissions to occur during saltwell pumping and also during performance of the support activities.

10.1 BACKGROUND INFORMATION

A primary question in determining the unabated emissions that would result from saltwell pumping and performance of the support activities involves the mechanism for formation of aerosols in the tank vapor space. Two mechanisms have been postulated to occur should operation of the exhausters become necessary during saltwell pumping: the release of trapped gas and associated aerosol generation, and resuspension of dry particulate material because of air currents created by the exhausters. Information available to date shows that saltwell pumping minimally disturbs the tank waste and vapor space.

This position is supported by modeling designed to predict gas release during intrusive activities, analysis of release scenarios conducted for the Tank Farm Final Safety Analysis Report, and operational experience gained from tanks SY-101 and AN-104. The following is a discussion of results from these activities.

Numeric modeling designed to predict gas release during saltwell pumping is documented (PNNL-11310 and TWSFG 96.14). Results state that, as the retreating liquid exposes the trapped gas bubbles, the trapped gas is released by diffusing through the connected gas channels to the surface of the salt cake or sludge. Thus, during saltwell pumping, gas release is characterized as a continuous, slow release process. The generation of additional aerosol radionuclides under these conditions is not foreseen.

Intrusion into the waste by water lancing, as described in Section 6.2, to install the saltwell screen or the jet pump assembly offers the possibility of increased concentrations of aerosol radionuclides because of the initial action of high pressure water from the lance on the waste and the potential for more rapid gas release from intrusion of the lance into the waste. A conservative gas release analysis, based on release scenarios including saltwell pumping, intrusion into the waste, and waste rollover, was performed (WHC-SD-WM-EMP-031). This study addressed flammable gas concentration changes in the vapor space as a function of release rates, and concluded that a rollover will release the largest amount of gas in a short time. The study also concluded that although a rollover is possible, a rollover is unlikely because changes in waste levels in SSTs have been small, which implies gas generation rates are balanced by gas release rates. The study also concluded that intrusion into the waste will release relatively small volumes of gas as compared to a rollover. The lowest gas release rates are characteristic of saltwell pumping. Considering the operational experience gained during May 1990 to December 1994 for SY-101 tank, it is considered unlikely that saltwell pumping or its support activities that intrude into the waste will cause gas releases that measurably will increase the radiological aerosol in the tank vapor space.

Operational experience with SY-101 tank suggests that more aggressive waste intrusive activities involving intermittent mixer pump operation and rollover would not contribute significantly to an increase in radionuclide aerosol concentration in the vapor space, due to the release of trapped gas to the surface. This is demonstrated by nondestructive assay analysis of HEPA filters in service on the SY-101 tank from May 1990 to December 1994. The analysis indicates the potential offsite cumulative dose of 1.5 E-03 millirem for the 4.5-year period (WHC-SD-WM-EMP-031). The type of gas releases experienced from SY-101 is not expected to occur during saltwell pumping or the performance of support activities. However, assuming a very conservative position that a rollover would occur, the experience with the SY-101 tank suggests a maximum increase in an annual dose of only 3.3 E-04 millirem per year, which has an insignificant affect on the dose analysis presented in Section 11.0.

Operational experience with the AN-104 tank shows episodic gas (hydrogen) release events occur approximately every 133 days. Although no monitoring of unabated emissions within the tank has occurred during these events, there is no evidence that abated emissions increased during these events.

Another potential source of an increase in the radiological aerosol concentration in the tank vapor space might be attributed to the dry waste surface believed to be present in several tanks. This scenario for potential increased emissions assumes a radiological source, in the form of dry particulates, has been deposited or has formed on top of the dry waste surface. When the exhauster is turned on, these particulates could become airborne. In-tank photography is not considered sensitive enough to verify the presence or absence of dry particulates. However, no mechanism is known for the generation or formation of such a condition. It is believed the dry surface in these tanks was formed by evaporation of liquid waste, which is expected to result in a hard surface on the resulting salt cake. Also considered unlikely is that air flow into the tank, because of exhauster operation, could generate sufficient turbulence to disturb particulates even if the particulates were present.

The action of a water lance on a potentially dry waste surface is not expected to contribute measurably to increased aerosols, as water from the water lance will wet the dry waste surfaces that might exist before lancing begins. As noted in Section 10.5, the resultant dose due to water lancing activities on a waste surface (wet or dry) has been increased by a conservative factor of 10. This accounts for the uncertainty regarding a potential increase in vapor space radionuclide particulates because of the use of the water lance on or in the waste.

Some tanks may emit a pungent noxious odor e that hinders workers' ability to perform their tasks. In the event these odors occur and, in conjunction with the established onsite industrial health and hygiene practices, a saltwell portable exhauster may be used to redirect emissions from the tank away from workers in the immediate area for worker comfort and safety. If the exhauster is operated, emissions will be monitored and reported.

10.2 DISCUSSION OF SOURCE TERM USED TO CALCULATE EMISSIONS

The emission estimates in this NOC are based on analyses of filter papers in sampling equipment used for vapor space sampling in support of worker health and safety issues. The vapor sample analysis did not include radionuclide analytes; therefore, analyses of the filter papers were used for this estimate.

Two types of vapor sampling systems were used: a truck mounted vapor sampling system (VSS) and/or a cart mounted in-situ vapor sampling system (ISVS). In both systems, filter papers were used to provide protection against radioactive contamination from reaching the sampling apparatus in the cart or truck. The filter papers have a minimum aerosol retention of 99.98 percent for particles of 0.3 micron median diameter. In the case of the VSS, the filters are mounted outside the tank while for the ISVS, the filters are mounted in the tank. In both cases, the filter papers are upstream from the sampling apparatus. Additional details of the sampling effort are documented (PNNL 1997).

10.3 POTENTIAL ANNUAL UNABATED EMISSIONS DURING SALTWELL PUMPING

Potential annual unabated emissions for each tank during saltwell pumping were estimated using the measured total alpha, total beta, and cesium-137 concentrations collected on filter papers used during vapor sampling of undisturbed vapor space in each tank (PNNL 2001).

10.3.1 Potential Annual Unabated Emissions During Saltwell Pumping Under Passive Ventilation Rates

Unabated emissions currently attributed to the tanks covered in this NOC are not expected to increase measurably as a result of saltwell pumping because the act of lowering the waste level by slowly removing the liquid wastes minimally disturbs the tank vapor space and waste. An estimate of those emissions, using the measured total alpha, total beta, and cesium-137 concentrations noted previously is presented in Appendix B. This estimate assumes a tank (passive) breathing rate of 0.28 cubic meters per minute to calculate potential unabated emissions. The methodology justifying this breathing rate was developed and used to estimate emissions from SSTs (DOE/RL-95-07).

10.3.2 Potential Annual Unabated Emissions During Saltwell Pumping With a Portable Exhauster In Operation

During saltwell pumping, the potential to emit would increase during operation of the exhauster. For conservatism, the emission calculations in Appendix C assume the exhauster was run at its maximum output of 34 cubic meters per minute, 24 hours per day, 365 days per year. (Planning schedules include a 60 percent pumping efficiency, which makes these calculations conservative.) The following is a sample calculation using the 241-S-109 tank alpha concentration data from the filter papers. (This tank was selected for exemplary purposes only, there is nothing unique about the tank.)

Unabated alpha emission =

$$\left(2.69\ \frac{pCi}{L}\right) x \left(10^{-12}\frac{Ci}{pCi}\right) x \left(\frac{1{,}200\frac{ft^3}{min}}{35.3\frac{ft^3}{M^3}}\right) x \left(10^3\frac{L}{M^3}\right) x \left(60\frac{min}{hr}\right) x$$

$$\left(24\frac{hr}{day}\right) x \left(365\frac{days}{year}\right) = 4.81\ E\text{-}2\frac{Ci}{year}.$$

10.4 POTENTIAL ANNUAL ABATED EMISSIONS DURING SALTWELL PUMPING

Potential annual abated emissions for each tank during saltwell pumping at an active ventilation rate of 34 cubic meters per minute and under passive breathing conditions are calculated from the unabated emissions and the decontamination factor for the HEPA filter.

In the case of active ventilation, the DF for the HEPA filter is equal to:

$$\frac{1}{1-\text{efficiency}} = \frac{1}{1-.9995} = 2E+03$$

The abated emissions equal the unabated emissions divided by the overall DF. The potential annual abated emissions for each tank during active ventilation are presented in Appendix C.

In the passive breathing case, a breather HEPA filter emission adjustment factor of .01, per Appendix D of 40 CFR 61, is multiplied by the calculated unabated emissions to arrive at abated emissions. The potential annual abated emissions for each tank during passive breathing are presented in Appendix B.

10.5 POTENTIAL ANNUAL UNABATED EMISSIONS DURING WATER LANCING

Potential annual unabated emissions during water lancing operations to insert the saltwell screen or the jet pump assembly in each tank also were estimated using the measured total alpha, total beta, and cesium-137 concentrations collected on filter papers used during vapor sampling of vapor space in each tank (PNNL 2001). However, as noted previously, use of a portable exhauster is not required during lancing operations. Therefore, to determine potential emissions during this operation, a tank breathing rate of 0.28 cubic meter per minute (Section 10.3.1) was used to calculate total potential emissions. As discussed in Section 10.3.1, this methodology was developed and used to estimate emissions from SSTs reported in the air operating permit (DOE/RL-95-07).

The dose calculations are shown in Appendix D. (Note that the resultant dose has been increased by a conservative factor of 10 to account for uncertainty regarding a potential increase in vapor space radionuclide particulates because of the use of the water lance on the waste and intrusion of the water lance into the waste (Section 10.1.)

10.6 POTENTIAL ANNUAL ABATED EMISSIONS DURING WATER LANCING

Potential abated emissions from water lancing under passive ventilation rates were estimated by multiplying the unabated emissions by a breather HEPA filter emission adjustment factor. The adjustment factor, 0.01, was taken from Appendix D of 40 CFR 61. Results are presented in Appendix D.

10.7 POTENTIAL ANNUAL UNABATED EMISSIONS DURING WATER ADDITION TO THE WASTE

Occasionally water will be added to the tank to prevent plugging of the saltwell screen and the waste line. The water will be piped from a storage tank through a metering system at an average rate of 280 liters per minute or less. Entry into the tank is made through the pump pit via an existing port on the pit cover and into the saltwell screen. No mechanism for increasing the concentration of radionuclides in the vapor space is foreseen as a result of this activity and therefore, no increase in the potential to emit is estimated.

10.8 POTENTIAL ANNUAL UNABATED EMISSIONS DURING TRANSFER LINE FLUSHING AND PLUG REMOVAL

Flushing of transfer lines and cleaning plugs from transfer lines are accomplished as described in Section 6.4. No mechanism for increasing the concentration of radionuclides in the vapor space is foreseen as a result of these activities and therefore, no increase in the potential to emit is estimated.

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11.0 OFFSITE IMPACT (REQUIREMENTS 14 AND 15)

This section presents information regarding the total effective dose equivalent (TEDE) to the hypothetical maximally exposed individual (MEI) resulting from unabated and abated emission estimates from saltwell pumping with active ventilation and, the unabated emissions from water lancing and saltwell pumping under passive tank ventilation rates.

For SSTs located in the 200 East Area, the onsite MEI public member is located 16.6 kilometers east-southeast at the Energy Northwest Nuclear Power Plant. For SSTs located in the 200 West Area, the onsite MEI public member is located 18.3 kilometers east-southeast at the LIGO site. The methods used to calculate public doses from radionuclide air emissions at the Hanford Site were submitted previously to the Washington State Department of Health (WDOH). The information required to calculate public doses is included in *Calculating Potential-to-Emit Releases and Doses for FEMPs and NOCs* (HNF-3602 Revision 1).

Potential unabated doses are calculated as the product of the unabated emissions and the applicable unit dose factor. These calculations assume the total alpha to be from americium-241, because americium provides the highest dose consequence of all alpha emitters, 15 millirem per curie (200E) and 17 millirem per curie (200W). The total beta activity is assumed to be strontium-90.

Appendix B provides the potential annual unabated dose and abated dose for each tank during saltwell pumping at passive tank breathing rates. The highest unabated dose expected is 3.00E-02 millirem per year from tank S-112.

Appendix C provides the potential annual unabated dose and abated dose for each tank during saltwell pumping under active ventilation assuming the most conservative case that the exhauster is run 24 hours per day, 365 days per year, at the maximum flow rate. Under these conditions, the following tanks exceed the regulatory dose criterion of 0.1 millirem per year TEDE to the MEI: for unabated emissions:

- 241-C-103 (1.72E+00 millirem per year)
- 241-S-101 (1.97E-01 millirem per year)
- 241-S-102 (2.01E-01 millirem per year)
- 241-S-103 (4.00E-01 millirem per year)
- 241-S-106 (2.85E-01 millirem per year)
- 241-S-107 (1.06E+00 millirem per year)
- 241-S-109 (9.68E-01 millirem per year)
- 241-S-112 (3.65E+00 millirem per year)
- 241-S-111 (1.59E-01 millirem per year).

The remaining tanks fall below the regulatory criterion of 0.1 millirem per year (unabated emissions). However, as discussed in Section 9.0, the monitoring system used with all portable exhausters will be compliant with 40 CFR 61, Subpart H and the reference requirements.

Appendix D provides the potential annual unabated dose and abated dose for each tank during water lancing operations. The analysis assumes water lancing operations will be performed under passive tank breathing rates for a period not to exceed 72 hours of actual water lancing. The 72-hour period will be controlled administratively. Also note that the resultant dose has been increased by a conservative factor of 10 to account for uncertainty regarding a potential increase in vapor space radionuclide particulates because of using the water lance on the waste and from intrusion of the water lance into the waste (Section 10.1). The highest potential unabated dose expected during water lancing operations from tank S-112 is 2.47E-04 millirem per year.

As discussed in Section 1.0, a portable exhauster also could be used to simultaneously exhaust more than one SST during saltwell pumping. Although the exact combination of tanks to be pumped or exhausted is not known it is likely that simultaneous pumping could occur.

As provided in Appendix C, the maximum abated dose for pumping all tanks at the same time under active ventilation is conservatively estimated at 4.51E-03 millirem per year. However, in actual practice, application of an exhauster to the tanks covered by this NOC is scheduled to occur from 1998 into the year 2003-2004. Although the exact schedule is not certain, it is extremely unlikely that all tanks will be ventilated at the same time.

The TEDE resulting from all Hanford Site operations in 2000 (point sources and diffuse and fugitive sources) was determined to be 0.095 millirem per year (DOE/RL-2000-32). The emissions resulting from water lancing and saltwell pumping, in conjunction with other current operations on the Hanford Site, will not violate the National Emission Standard for Hazardous Air Pollutants of 10 millirem per year.

12.0 COST FACTORS AND FACILITY LIFETIME (REQUIREMENTS 16 AND 17)

It is proposed that the HEPA filtration systems portable exhausters, for the portable exhausters as described in Section 8.0, be approved as best available radionuclide control technology (BARCT) for saltwell pumping activities when active ventilation is required. The WDOH has provided guidance in the past that HEPA filtration is considered BARCT for particulate emissions. It also is proposed that the passive breather filters, also described in Section 8.0, be approved as low as reasonably achievable control technology (ALARACT) for saltwell pumping activities performed in the passive ventilation mode. As such, cost factors for construction, operation, and maintenance of the control technology components and system have not been provided.

The minimum design life of the portable exhauster equipment is 10 years. Each exhauster could be operated continuously or intermittently for the duration of the pumping campaign. Pumping operations could be in a continuous mode for up to 3 or more years. Operations will be conducted up to 24 hours a day, 7 days a week.

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13.0 TECHNOLOGY STANDARDS (REQUIREMENT 18)

During active ventilation, the emissions control equipment employed on the portable exhausters to be used on tanks included in this NOC adhere to the compliance standards as noted in Table 13-1. This table summarizes the compliance of emissions control equipment with the listed technology standards for tanks with a potential to emit greater than 0.1 millirem per year TEDE to the MEI as discussed in Sections 9.0 and 11.0.

In the passive breathing mode, none of the saltwell activities have the potential to emit greater than 0.1 millirem per year TEDE to the MEI. Therefore, the design of the HEPA breather filters must meet, as applicable and to the extent justified by a cost/benefit evaluation, the technology standards listed under WAC 246-247-110(18). Table 13-2 summarizes the compliance of emissions control equipment listed with technology standards

Table 13-1. Emissions Control Equipment Standards Compliance for Portable Exhausters. (4 sheets)

Standard	Does design comply?	Notes
ASME/ANSI AG-1	Yes	The quality assurance section of AG-1 relies on ASME NQA-1. The general QA criteria are located in Section AA. Specific component/system criteria are located in each section throughout AG-1. The portable exhauster was built on site and meets the site's QA program (current version RPP-MP-600). This includes procurement of the safety material/components, along with appropriate pedigree from an evaluated supplier, tracking and maintaining the material/components after it arrived on site, inspection of the material/components, and witnessing the testing. This equipment specific code consists of five primary sections, which are applicable to this unit. The applicable sections are fans (Section BA), ductwork (Section SA), HEPA filter housing (Section HA), HEPA filters (Section FC), dampers (Section DA), heaters (Section CA) and Quality Assurance (QA) (Section AA). AG-1 contains several other sections, however they do not apply to this system. The fan section of AG-1 (Section BA) covers the construction and testing requirements for fans. This fan meets the applicable criteria identified in AG-1, except as identified below. It was constructed to the Air Movement and Control Association (AMCA) 99-401, Spark Resistant Construction, criteria, and was tested to the applicable sections of AMCA 210. However, it can not be shown the shaft leakage criteria is met (Section BA 4142.2). This is acceptable because a "stuffing box" is installed around the shaft to minimize the leakage, and the leakage point is located after the HEPA filters. (continued)

Table 13-1. Emissions Control Equipment Standards Compliance for Portable Exhausters. (4 sheets)

Standard	Does design comply?	Notes
ASME/ANSI AG-1 (continued)		The next applicable requirement is the ductwork section of AG-1 (Section SA). As was the case for the fan, this section identifies several requirements for ductwork. This includes acceptable material, fabrication, and testing criteria. The ductwork used will be a combination of both metal and flexible polymer. In both cases it does meet the applicable criteria and will be pressure tested per the applicable criteria identified in AG-1 and N510 prior to operation The HEPA filter housing section (Section HA) was recently released and this section has taken the place of the requirements identified in N509. After reviewing the requirements identified in Section HA against the portable exhauster design, the portable exhauster filter housings are in compliance. The HEPA filter section of AG-1 (Section FC) is also applicable in this instance. The criteria identified in AG-1 were previously located in military specification 51068 and ASME 509. The filters, which will be installed in the exhauster, will meet the applicable sections of AG-1, except for two areas dealing with filter qualification testing. Justification for this exception was discussed with and approved by WDOH at the December, 1998 Routine Technical Assistance Meeting. The dampers installed on the portable exhauster do meet the applicable AG-1 criteria. This includes design, construction and testing. The manufacturer performed a leak test on the valves, and a pressure decay test was also completed on the exhaust train system. For the pressure decay test, the valves were used for isolation. The test was successful. The heater installed in the portable exhauster meets the requirements of AG-1, Section CA. The heater relies on a glycol mixture that is heated by a separate heating unit, similar to a hot water tank. The heated glycol is then pumped through the heating coil located inside the exhaust system. The reason for this type of design is to allow this system to be used in a flammable gas environment. It would be very expensive and space consuming to rely on an electric heater to satisfy the flammable gas requirements. By using a glycol heater, there are no electrical, sparking or energized components in contact with the air stream. In addition, controls are in place to prevent the damage of the HEPA filters if the coil were to fail. This includes level detection in the glycol reservoir, which will detect the loss of glycol. Also, differential pressure across the first HEPA filter is monitored. If the coil were to break, the differential pressure across the first HEPA would increase and the system would be shutdown.
ASME/ANSI N509	Yes	This standard deals with the individual components and how they relate to the overall system. The major sections of N509 have been replaced with those identified in AG-1. There are certain sections that are still applicable, such as Section 4.3, which discusses the maximum flow rate for the system not to exceed the lowest maximum rating of any component installed in the system. This is being met, along with the other applicable sections of N509. (see AG-1)

Table 13-1. Emissions Control Equipment Standards Compliance for Portable Exhausters. (4 sheets)

Standard	Does design comply?	Notes
ASME/ANSE N510	Yes	This standard pertains to the testing of nuclear air cleaning systems. The first requirement identified in N510 is to perform a pressure decay test. This is to assure there are no infiltration or outward leak paths from the system. This test was completed on the portable exhauster and was successful. This system meets the leak test criteria identified per N510. Test sections are located in the exhaust train to allow for proper independent testing of both HEPA filters.
ANSI/ASME NQA-1	Yes	NQA-1 was met for the system design, procurement and construction. Either the material and components were purchased from a supplier having a quality assurance program equivalent to NQA-1, or the supplier was evaluated and was on the Hanford Evaluated Suppliers List (ESL), or dedication was performed on the materials and components that were purchased from manufacturers not having a quality assurance program.
40 CFR 61.93 (b) (3)	Yes	
ANSI N13.1	NA	Shrouded probe via alternate method allowed per EPA (1994) The sampling system for the portable exhausters meets the intent of N13.1 (1999). A shrouded probe is used for particulate sampling and the probe and configuration has been tested in accordance with the standard. A splitter is installed directly after the probe, which routes the sample to both the record sample and continuous air monitor. Both branches are equipped with flow measuring and control instruments.
40 CFR 52, Appendix E	No	The exhausters are designed to meet the intent of the requirement. A 168 hour test will be performed. The exhauster is fitted with a variable frequency drive (VFD) controllers for the unit fans to maintain specified airflow with in specified tolerance. Because of this the Orientation Sensitivity test results will not demonstrate compliance directly. Compliance is based on the design of the unit.
40 CFR 60, Appendix A Test Methods: 1, 1A, 2, 2A, 2C, 2D, 4	Yes/No	Method 1: This method is not applicable to these portable exhausters because the exhaust stack diameter is < 12 inches Method 1A: This method is being used and is identical to method 1, except it is for stack diameters < 12 inches. Method 2: This method is not used because the S pitot tube is used for the larger stacks (i.e., diameter > 12 inches). Method 2A: This section applies to volume meters and therefore, does not apply for this application. The method being used for flow measurement is a standard pitot tube measuring the static pressure and total pressure, then converting that information over to a corresponding velocity pressure. That is then converted into a velocity. *(continued)*

Table 13-1. Emissions Control Equipment Standards Compliance for Portable Exhausters. (4 sheets)

Standard	Does design comply?	Notes
40 CFR 60, Appendix A Test Methods: 1, 1A, 2, 2A, 2C, 2D, 4 (continued)		Method 2C: This method is used and a standard pitot tube is used for the measuring. The other sections of Method 2 applicable to a standard pitot tube are also relied upon. Method 2D: This method is not used for these systems. This method relies upon a rotameter, orifice or similar device. The method being used in our application is method 2C relying upon a pitot tube. Method 4: This method is not used. Instead a humidity probe is used to determine moisture content of the stream. The humidity value determined from this instrument is mathematically incorporated into the final flow measurement.
40 CFR 60, Appendix A Test Methods: 5, 17	NA	Methods 5 and 17: This method is not relied upon, rather ANSI N13.1 (1999) was relied upon for the sampling system.

Table 13-2. Emissions Control Equipment Standards Compliance for Breather Filters.

Standard	Does design comply?	Notes
ASME/ANSI AG-1	No	Filters installed meet AG-1. Housing were fabricated prior to AG-1
ASME/ANSI N509	No/Yes	Open face design does not meet N509. G-1 housing design meets N509.
ASME/ANSE N510	Yes	The Flander/CSC G-1 housing design meets N509/N510.
ANSI/ASME NQA-1	Yes/No	Current version of QA program is RPP-MP-600.
ANSI N13.1	NA	Not required for periodic confirmatory measurement. Confirmatory measurements will consist of smears on the filter.
40 CFR 52, Appendix E	NA	Not required for periodic confirmatory measurement. Confirmatory measurements will include differential pressure, periodic filter aerosol testing, and filter housing radiological surveys.
40 CFR 60, Appendix A Test Methods: 1, 1A, 2, 2A, 2C, 2D, 4	NA	Filter testing required for air flow related to ASME N510. Other methods not required because emission collection and measurement is not required.
40 CFR 60, Appendix A Test Methods: 5, 17	NA	These methods are for sampling system designs. Periodic confirmatory measurement will be taken via smears in lieu of a sampling system.

Table 13-3. Emission Control Equipment Standards Compliance for RMCS Exhauster Approved in DOE-RL-97-70 Rev 0*

Standard	Does design comply?	Notes
ASME/ANSI AG-1	No	Ductwork per ASTM A245
ASME/ANSI N509	No	Equipment per ASTM A36
ASME/ANSI N510	No	Welding per HW-4926-S Rev 7
ASME/ANSI NQA-1	No	Design filters and test ports per HWS-7511-S [Filter test procedures are written per ASME/ANSI N510 as close as possible within the design limits of HWS-75111-S]
ANSI N13.1	No (HNF 1997d)	Not required for periodic confirmatory measurement
40 CFR 60, Appendix A Test Methods: 1, 1A	No (HNF 1997d)	Not required for periodic confirmatory measurement
Test Methods: 2, 2A, 2C, 2D		
Test Method: 4		
Test Method 5, 17		

* *Radioactive Air Emissions Notice of Construction for Rotary Mode Core Sampling in SX Tank Farm*

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APPENDIX A

TANK RADIONUCLIDE INVENTORY

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APPENDIX A

TANK RADIONUCLIDE INVENTORY

Table A-1. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-A-101 Decayed to January 1, 2001, Effective July 1, 2001.

Analyte	Total Inventory (Ci)	Analyte	Total Inventory (Ci)
3H	4.68E+02	226Ra	6.01E-04
14C	1.15E+02	227Ac	3.70E-03
59Ni	8.08E+00	228Ra	8.94E-01
60Co	6.16E+01	229^{Th}	2.08E-02
63Ni	7.67E+02	231Pa	1.35E-02
79Se	1.31E+00	232Th	1.09E-01
90Sr	1.74E+05	232U	1.54E+00
90Y	1.74E+05	233U	6.32E+00
93Zr	6.35E+01	234U	1.08E+00
93mNb	4.70E+01	235U	4.28E-02
99Tc	8.95E+02	236U	3.46E-02
106Ru	2.99E-04	237Np	3.16E+00
113mCd	2.39E+02	238Pu	4.68E+00
125Sb	1.09E+02	238U	9.62E-01
126Sn	7.95E+00	239Pu	1.57E+02
129i	1.73E+00	240Pu	2.76E+01
134Cs	1.33E+00	241Am	4.20E+02
137Cs	1.18E+06	241Pu	2.48E+02
137mBa	1.12E+06	242Cm	5.68E-01
151Sm	4.41E+04	242Pu	1.92E-03
152Eu	1.25E+01	243Am	1.36E-02
154Eu	5.13E+02	243Cm	4.18E-02
155Eu	2.41E+02	244Cm	6.82E-01

Table A-2. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-AX-101 Decayed to January 1, 2001, Effective October 1, 2001.

Analyte	Total Inventory (Ci)
3H	3.38E+02
14C	8.84E+01
59Ni	1.09E+01
60Co	5.26E+01
63Ni	1.03E+03
79Se	1.19E+00
90Sr	1.61E+05
90Y	1.61E+05
93Zr	5.65E+01
93mNb	4.35E+01
99Tc	6.46E+02
106Ru	4.11E-04
113mCd	1.85E+02
125Sb	8.80E+01
126Sn	7.34E+00
129i	1.25E+00
134Cs	9.71E-01
137Cs	8.74E+05
137mBa	8.27E+05
151Sm	4.05E+04
152Eu	1.07E+01
154Eu	9.83E+02
155Eu	3.38E+02

Analyte	Total Inventory (Ci)
226Ra	7.77E-04
227Ac	3.79E-03
228Ra	7.23E-01
229Th	1.68E-02
231Pa	1.25E-02
232Th	8.81E-02
232U	5.69E-01
233U	2.33E+00
234U	3.74E-01
235U	1.48E-02
236U	1.21E-02
237Np	2.29E+00
238Pu	6.78E+00
238U	3.32E-01
239Pu	1.96E+02
240Pu	3.62E+01
241Am	2.27E+02
241Pu	3.63E+02
242Cm	2.30E-01
242Pu	2.98E-03
243Am	1.12E-02
243Cm	1.80E-02
244Cm	5.04E-01

Table A-3. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-BY-105 Decayed to January 1, 2001, Effective January 1, 2002.

Analyte	Total Inventory (Ci)	Analyte	Total Inventory (Ci)
3H	1.83E+02	226Ra	3.33E-04
14C	7.71E+01	227Ac	8.95E-03
59Ni	9.81E+00	228Ra	2.01E+00
60Co	2.30E+01	229Th	9.56E-02
63Ni	9.16E+02	231Pa	2.52E-02
79Se	6.61E-01	232Th	6.79E-04
90Sr	1.59E+05	232U	1.44E-01
90Y	1.59E+05	233U	5.88E-01
93Zr	3.18E+01	234U	3.17E+00
93mNb	2.57E+01	235U	1.38E-01
99Tc	8.17E+01	236U	3.76E-02
106Ru	1.17E-04	237Np	3.07E-01
113mCd	1.18E+02	238Pu	8.32E+00
125Sb	5.14E+01	238U	3.16E+00
126Sn	3.95E+00	239Pu	3.53E+02
129i	7.64E-01	240Pu	5.62E+01
134Cs	3.34E-01	241Am	1.74E+02
137Cs	1.81E+05	241Pu	4.46E+02
137mBa	1.71E+05	242Cm	5.58E-01
151Sm	2.16E+04	242Pu	3.00E-03
152Eu	7.71E+00	243Am	4.77E-03
154Eu	6.79E+02	243Cm	9.97E-03
155Eu	2.51E+02	244Cm	5.37E-03

Table A-4. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-BY-106 Decayed to January 1, 2001, Effective January 1, 2002.

Analyte	Total Inventory (Ci)	Analyte	Total Inventory (Ci)
3H	1.70E+02	226Ra	2.96E-04
14C	6.98E+01	227Ac	7.92E-03
59Ni	8.51E+00	228Ra	1.85E+00
60Co	2.44E+01	229Th	8.52E-02
63Ni	7.96E+02	231Pa	2.23E-02
79Se	5.95E-01	232Th	1.21E-01
90Sr	1.47E+05	232U	6.07E-02
90Y	1.47E+05	233U	2.49E-01
93Zr	2.86E+01	234U	2.09E+00
93mNb	2.31E+01	235U	9.19E-02
99Tc	3.64E+02	236U	2.23E-02
106Ru	1.06E-04	237Np	1.22E+00
113mCd	1.07E+02	238Pu	5.02E-01
125Sb	4.75E+01	238U	2.09E+00
126Sn	3.56E+00	239Pu	3.31E+01
129i	7.06E-01	240Pu	4.09E+00
134Cs	3.02E-01	241Am	3.26E+01
137Cs	3.93E+05	241Pu	2.43E+01
137mBa	3.72E+05	242Cm	3.74E-01
151Sm	1.95E+04	242Pu	1.63E-04
152Eu	6.85E+00	243Am	3.98E-04
154Eu	1.70E+02	243Cm	6.69E-03
155Eu	2.23E+02	244Cm	3.37E-03

Table A-5. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-C-103 Decayed to January 1, 2001, Effective January 1, 2002.

Analyte	Total Inventory (Ci)
3H	9.96E+00
14C	4.89E+00
59Ni	3.84E+01
60Co	7.24E+02
63Ni	3.58E+03
79Se	1.76E+00
90Sr	3.01E+06
90Y	3.01E+06
93Zr	7.42E+01
93mNb	6.89E+01
99Tc	3.42E+01
106Ru	4.15E-05
113mCd	4.23E+01
125Sb	9.70E+00
126Sn	1.15E+01
129i	6.62E-02
134Cs	2.06E-01
137Cs	9.61E+04
137mBa	9.09E+04
151Sm	6.40E+04
152Eu	1.86E+01
154Eu	5.49E+03
155Eu	3.29E+03

Analyte	Total Inventory (Ci)
226Ra	2.47E-03
227Ac	1.39E-02
228Ra	1.54E-04
229Th	1.32E-04
231Pa	1.79E-02
232Th	3.07E-05
232U	5.35E-02
233U	2.20E-01
234U	1.95E+00
235U	8.32E-02
236U	3.48E-02
237Np	1.08E-01
238Pu	6.79E+01
238U	1.99E+00
239Pu	4.21E+03
240Pu	6.49E+02
241Am	3.13E+03
241Pu	3.61E+03
242Cm	3.93E+00
242Pu	2.02E-02
243Am	7.20E-02
243Cm	2.36E-01
244Cm	1.78E+00

Table A-6. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-S-101 Decayed to January 1, 2001, Effective January 1, 2001.

Analyte	Total Inventory (Ci)
3H	1.59E+02
14C	2.89E+01
59Ni	7.78E+00
60Co	1.67E+01
63Ni	7.01E+02
79Se	4.24E-01
90Sr	6.06E+05
90Y	6.06E+05
93Zr	2.05E+01
93mNb	1.57E+01
99Tc	2.06E+02
106Ru	3.90E-05
113mCd	5.18E+01
125Sb	7.12E+01
126Sn	2.58E+00
129i	4.12E-01
134Cs	2.48E-01
137Cs	3.47E+05
137mBa	3.28E+05
151Sm	1.42E+04
152Eu	4.98E+00
154Eu	1.41E+02
155Eu	3.22E+02

Analyte	Total Inventory (Ci)
226Ra	5.61E-04
227Ac	2.58E-03
228Ra	4.78E-02
229Th	1.19E-03
231Pa	5.72E-03
232Th	4.62E-03
232U	6.35E-01
233U	2.60E+00
234U	3.31E+00
235U	1.38E-01
236U	8.96E-02
237Np	8.19E-01
238Pu	8.92E+00
238U	3.11E+00
239Pu	5.48E+02
240Pu	8.00E+01
241Am	1.22E+02
241Pu	3.92E+02
242Cm	2.25E-01
242Pu	2.58E-03
243Am	3.86E-03
243Cm	1.41E-02
244Cm	1.21E-01

Table A-7. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-S-102 Decayed to January 1, 2001, Effective January 1, 2001.

Analyte	Total Inventory (Ci)	Analyte	Total Inventory (Ci)
3H	2.09E+02	226Ra	2.47E-04
14C	4.78E+01	227Ac	1.34E-03
59Ni	3.00E+00	228Ra	8.89E-02
60Co	1.76E+01	229Th	2.20E-03
63Ni	2.75E+02	231Pa	4.82E-03
79Se	3.88E-01	232Th	9.50E-03
90Sr	9.29E+04	232U	1.42E+00
90Y	9.29E+04	233U	5.83E+00
93Zr	1.90E+01	234U	1.81E+00
93mNb	1.39E+01	235U	7.35E-02
99Tc	2.17E+02	236U	5.63E-02
106Ru	5.74E-05	237Np	1.30E+00
113mCd	6.95E+01	238Pu	2.96E+00
125Sb	3.18E+01	238U	1.65E+00
126Sn	2.35E+00	239Pu	1.15E+02
129i	6.81E-01	240Pu	1.90E+01
134Cs	3.54E-01	241Am	1.23E+02
137Cs	2.55E+05	241Pu	1.49E+02
137mBa	2.41E+05	242Cm	3.02E-01
151Sm	1.30E+04	242Pu	1.14E-03
152Eu	3.50E+00	243Am	4.20E-03
154Eu	2.46E+02	243Cm	2.41E-02
155Eu	2.70E+02	244Cm	2.17E-01

Table A-8. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-S-103 Decayed to January 1, 2001, Effective January 1, 2001.

Analyte	Total Inventory (Ci)
3H	1.34E+02
14C	3.11E+01
59Ni	2.15E+00
60Co	1.92E+01
63Ni	1.98E+02
79Se	2.80E-01
90Sr	4.10E+04
90Y	4.10E+04
93Zr	1.37E+01
93mNb	1.01E+01
99Tc	2.24E+02
106Ru	4.11E-05
113mCd	4.99E+01
125Sb	2.27E+01
126Sn	1.69E+00
129i	4.32E-01
134Cs	2.25E-01
137Cs	2.17E+05
137mBa	2.06E+05
151Sm	9.36E+03
152Eu	2.43E+00
154Eu	5.96E+02
155Eu	3.68E+02
226Ra	1.62E-04
227Ac	9.09E-04
228Ra	5.55E-02
229^{Th}	1.39E-03
231Pa	3.48E-03
232Th	5.81E-03
232U	7.35E-02
233U	3.02E-01
234U	2.91E-01
235U	1.23E-02
236U	6.90E-03
237Np	8.24E-01
238Pu	4.06E+00
238U	2.82E-01
239Pu	1.82E+02
240Pu	2.88E+01
241Am	1.22E+02
241Pu	2.04E+02
242Cm	1.71E-02
242Pu	1.51E-03
243Am	3.91E-03
243Cm	3.80E-04
244Cm	1.06E-03

Table A-9. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-S-106 Decayed to January 1, 2001, Effective January 1, 2001.

Analyte	Total Inventory (Ci)
3H	1.75E+02
14C	5.89E+01
59Ni	6.47E+00
60Co	4.07E+01
63Ni	6.00E+02
79Se	7.78E-01
90Sr	3.91E+04
90Y	3.91E+04
93Zr	3.82E+01
93mNb	2.80E+01
99Tc	2.88E+02
106Ru	1.13E-04
113mCd	1.38E+02
125Sb	6.18E+01
126Sn	4.72E+00
129i	5.56E-01
134Cs	3.31E-01
137Cs	2.90E+05
137mBa	2.75E+05
151Sm	2.60E+04
152Eu	6.15E+00
154Eu	1.76E+02
155Eu	4.96E+02

Analyte	Total Inventory (Ci)
226Ra	3.50E-04
227Ac	2.17E-03
228Ra	1.05E-01
229Th	2.75E-03
231Pa	9.72E-03
232Th	1.03E-02
232U	3.83E-02
233U	1.57E-01
234U	2.36E-01
235U	9.92E-03
236U	5.98E-03
237Np	1.07E+00
238Pu	9.45E-01
238U	2.26E-01
239Pu	5.29E+01
240Pu	7.80E+00
241Am	1.97E+01
241Pu	4.24E+01
242Cm	3.53E-02
242Pu	2.84E-04
243Am	5.86E-04
243Cm	2.78E-03
244Cm	2.82E-02

Table A-10. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-S-107 Decayed to January 1, 2001, Effective January 1, 2001.

Analyte	Total Inventory (Ci)	Analyte	Total Inventory (Ci)
3H	2.55E+01	226Ra	5.09E-04
14C	4.89E+00	227Ac	1.98E-03
59Ni	7.03E+00	228Ra	3.23E-03
60Co	1.42E+02	229^{Th}	1.59E-04
63Ni	6.24E+02	231Pa	7.97E-04
79Se	6.05E-02	232Th	4.62E-04
90Sr	3.43E+05	232U	1.07E-01
90Y	3.43E+05	233U	4.36E-01
93Zr	2.92E+00	234U	7.26E+00
93mNb	2.44E+00	235U	2.85E-01
99Tc	3.16E+01	236U	3.73E-01
106Ru	3.21E-05	237Np	1.12E-01
113mCd	9.13E+00	238Pu	6.93E+01
125Sb	3.20E+00	238U	5.75E+00
126Sn	3.69E-01	239Pu	1.75E+03
129i	6.73E-02	240Pu	3.14E+02
134Cs	5.92E-02	241Am	6.91E+01
137Cs	1.87E+05	241Pu	2.85E+03
137mBa	1.77E+05	242Cm	1.50E-01
151Sm	2.02E+03	242Pu	2.28E-02
152Eu	3.27E+00	243Am	1.22E-03
154Eu	3.73E+01	243Cm	1.06E-02
155Eu	9.35E+01	244Cm	1.46E-01

Table A-11. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-S-109 Decayed to January 1, 2001, Effective June 11, 2001.

Analyte	Total Inventory (Ci)	Analyte	Total Inventory (Ci)
3H	1.91E+02	226Ra	4.45E-04
14C	6.53E+01	227Ac	2.63E-03
59Ni	8.03E+00	228Ra	1.18E-01
60Co	3.66E+01	229Th	3.07E-03
63Ni	7.42E+02	231Pa	1.09E-02
79Se	8.73E-01	232Th	1.15E-02
90Sr	6.05E+04	232U	1.78E-02
90Y	6.05E+04	233U	7.30E-02
93Zr	4.28E+01	234U	1.90E-01
93mNb	3.14E+01	235U	8.10E-03
99Tc	3.13E+02	236U	3.70E-03
106Ru	1.26E-04	237Np	1.16E+00
113mCd	1.55E+02	238Pu	1.16E+00
125Sb	6.91E+01	238U	1.89E-01
126Sn	5.29E+00	239Pu	8.11E+01
129i	6.04E-01	240Pu	1.17E+01
134Cs	3.63E-01	241Am	1.01E+01
137Cs	4.76E+04	241Pu	5.33E+01
137mBa	4.51E+04	242Cm	3.84E-02
151Sm	2.92E+04	242Pu	3.49E-04
152Eu	7.12E+00	243Am	2.50E-04
154Eu	1.68E+02	243Cm	1.70E-03
155Eu	1.44E+02	244Cm	1.28E-02

Table A-12. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-S-111 Decayed to January 1, 2001, Effective January 1, 2002.

Analyte	Total Inventory (Ci)
3H	1.85E+02
14C	4.81E+01
59Ni	7.58E+00
60Co	2.31E+01
63Ni	6.88E+02
79Se	5.36E-01
90Sr	4.84E+05
90Y	4.84E+05
93Zr	2.62E+01
93mNb	2.14E+01
99Tc	3.00E+02
106Ru	7.57E-05
113mCd	9.40E+01
125Sb	4.16E+01
126Sn	3.25E+00
129i	5.79E-01
134Cs	3.00E-01
137Cs	3.52E+05
137mBa	3.33E+05
151Sm	1.79E+04
152Eu	5.38E+00
154Eu	2.50E+02
155Eu	5.06E+02
226Ra	5.09E-04
227Ac	3.48E-03
228Ra	3.79E-02
229^{Th}	1.85E-03
231Pa	6.72E-03
232Th	6.90E-03
232U	6.23E-02
233U	2.56E-01
234U	1.79E-01
235U	7.41E-03
236U	4.93E-03
237Np	1.12E+00
238Pu	6.10E-01
238U	1.68E-01
239Pu	3.39E+01
240Pu	5.08E+00
241Am	1.37E+01
241Pu	2.86E+01
242Cm	3.13E-02
242Pu	2.00E-04
243Am	4.22E-04
243Cm	2.23E-03
244Cm	2.10E-02

Table A-13. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-S-112 Decayed to January 1, 2001, Effective January 1, 2002.

Analyte	Total Inventory (Ci)	Analyte	Total Inventory (Ci)
3H	3.08E+02	226Ra	5.98E-04
14C	3.59E+01	227Ac	6.12E-03
59Ni	1.08E+01	228Ra	8.46E-02
60Co	6.47E+01	229Th	4.50E-03
63Ni	9.97E+02	231Pa	1.59E-02
79Se	1.73E+00	232Th	1.35E-03
90Sr	1.07E+05	232U	2.78E-01
90Y	1.07E+05	233U	7.11E+00
93Zr	6.26E+01	234U	4.65E+00
93mNb	5.09E+01	235U	2.01E-02
99Tc	2.47E+02	236U	2.51E-02
106Ru	1.84E-04	237Np	1.56E+00
113mCd	2.26E+02	238Pu	8.10E+00
125Sb	1.01E+02	238U	4.52E-01
126Sn	7.73E+00	239Pu	6.08E+01
129i	8.43E-01	240Pu	9.36E+00
134Cs	5.68E-01	241Am	7.24E+01
137Cs	2.26E+05	241Pu	5.78E+01
137mBa	2.14E+05	242Cm	1.14E-02
151Sm	4.27E+04	242Pu	4.16E-04
152Eu	1.02E+01	243Am	7.60E+01
154Eu	2.05E+02	243Cm	5.63E-01
155Eu	1.96E+02	244Cm	1.35E+01

Table A-14. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-T-104 Decayed to January 1, 2001, Effective January 1, 2001. (2 sheets)

Analyte	Total Inventory (Ci)	Analyte	Total Inventory (Ci)
3H	3.40E-01	226Ra	6.49E-06
14C	6.91E-02	227Ac	4.08E-05
59Ni	3.04E-02	228Ra	7.64E-11
60Co	9.38E-03	229^{Th}	2.43E-08
63Ni	2.60E+00	231Pa	7.16E-05
79Se	2.26E-03	232Th	3.09E-11
90Sr	3.38E+03	232U	7.58E-06
90Y	3.38E+03	233U	4.10E-07
93Zr	1.07E-01	234U	6.28E-01
93mNb	9.57E-02	235U	2.03E-02
99Tc	9.74E-01	236U	6.06E-03
106Ru	7.50E-11	237Np	4.58E-03
113mCd	1.85E-01	238Pu	2.57E+00
125Sb	3.69E-03	238U	4.64E-01
126Sn	1.35E-02	239Pu	1.93E+02
129i	1.40E-03	240Pu	2.33E+01
134Cs	8.20E-05	241Am	2.78E+01
137Cs	2.57E+02	241Pu	9.06E+01
137mBa	2.43E+02	242Cm	7.16E-02
151Sm	7.98E+01	242Pu	1.15E-03
152Eu	2.08E-02	243Am	1.84E-04
154Eu	2.69E+00	243Cm	1.28E-03
155Eu	1.78E+00	244Cm	3.33E-03

Table A-15. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-T-110 Decayed to January 1, 2001. Effective January 1, 2001. (2 sheets)

Analyte	Total Inventory (Ci)
3H	3.49E-02
14C	1.82E-02
59Ni	5.18E-03
60Co	1.52E-03
63Ni	4.40E-01
79Se	3.83E-04
90Sr	3.07E+04
90Y	3.07E+04
93Zr	1.83E-02
93mNb	1.63E-02
99Tc	1.26E-01
106Ru	1.11E-11
113mCd	3.08E-02
125Sb	5.76E-04
126Sn	2.30E-03
129i	2.37E-04
134Cs	1.27E-05
137Cs	5.00E+04
137mBa	4.73E+04
151Sm	1.35E+01
152Eu	9.47E-03
154Eu	3.76E-02
155Eu	3.88E-01
226Ra	1.17E-06
227Ac	7.34E-06
228Ra	2.87E-11
229Th	1.04E-08
231Pa	1.28E-05
232Th	5.29E-12
232U	6.73E-06
233U	3.97E-07
234U	5.05E-01
235U	2.26E-02
236U	3.61E-03
237Np	7.74E-04
238Pu	4.21E-01
238U	5.12E-01
239Pu	8.49E+01
240Pu	6.38E+00
241Am	1.55E-01
241Pu	1.03E+01
242Cm	1.38E-04
242Pu	6.34E-05
243Am	1.17E-07
243Cm	2.45E-06

Table A-16. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-U-102 Decayed to January 1, 2001, Effective October 1, 2001. (2 sheets)

Analyte	Total Inventory (Ci)	Analyte	Total Inventory (Ci)
3H	1.09E+02	226Ra	3.53E-04
14C	3.23E+01	227Ac	2.31E-03
59Ni	5.68E+00	228Ra	5.75E-02
60Co	2.37E+01	229^{Th}	2.16E-03
63Ni	5.17E+02	231Pa	4.86E-03
79Se	3.78E-01	232Th	8.28E-03
90Sr	2.07E+05	232U	7.43E-02
90Y	2.07E+05	233U	3.05E-01
93Zr	1.86E+01	234U	6.00E-01
93mNb	1.47E+01	235U	2.56E-02
99Tc	1.86E+02	236U	1.17E-02
106Ru	5.56E-05	237Np	6.75E-01
113mCd	6.84E+01	238Pu	6.41E+00
125Sb	3.08E+01	238U	5.96E-01
126Sn	2.28E+00	239Pu	3.65E+02
129i	3.59E-01	240Pu	5.45E+01
134Cs	2.27E-01	241Am	1.13E+02
137Cs	2.65E+05	241Pu	3.08E+02
137mBa	2.50E+05	242Cm	7.59E-02
151Sm	1.27E+04	242Pu	2.17E-03
152Eu	4.03E+00	243Am	3.45E-03
154Eu	4.31E+02	243Cm	1.52E-03
155Eu	6.13E+02	244Cm	1.46E-03

Table A-17. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-U-103 Decayed to January 1, 2001, Effective January 1, 2001. (2 sheets)

Analyte	Total Inventory (Ci)	Analyte	Total Inventory (Ci)
3H	1.54E+02	226Ra	2.58E-04
14C	4.76E+01	227Ac	1.51E-03
59Ni	4.05E+00	228Ra	8.41E-02
60Co	3.11E+01	229Th	2.14E-03
63Ni	3.74E+02	231Pa	6.22E-03
79Se	4.99E-01	232Th	8.58E-03
90Sr	5.17E+04	232U	1.46E-01
90Y	5.17E+04	233U	6.00E-01
93Zr	2.45E+01	234U	5.05E-01
93mNb	1.79E+01	235U	2.11E-02
99Tc	2.56E+02	236U	1.30E-02
106Ru	7.28E-05	237Np	9.47E-01
113mCd	8.88E+01	238Pu	3.79E+00
125Sb	4.01E+01	238U	4.82E-01
126Sn	3.03E+00	239Pu	1.38E+02
129i	4.95E-01	240Pu	2.33E+01
134Cs	2.76E-01	241Am	1.68E+02
137Cs	3.09E+05	241Pu	1.93E+02
137mBa	2.92E+05	242Cm	4.29E-01
151Sm	1.67E+04	242Pu	1.49E-03
152Eu	4.15E+00	243Am	5.91E-03
154Eu	1.15E+03	243Cm	3.48E-02
155Eu	7.08E+02	244Cm	3.06E-01

Table A-18. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-U-105 Decayed to January 1, 2001, Effective April 1, 2001. (2 sheets)

Analyte	Total Inventory (Ci)
3H	2.11E+02
14C	5.27E+01
59Ni	2.02E+00
60Co	5.32E+01
63Ni	1.88E+02
79Se	3.95E-01
90Sr	1.97E+04
90Y	1.97E+04
93Zr	1.94E+01
93mNb	1.46E+01
99Tc	3.60E+02
106Ru	6.01E-05
113mCd	7.21E+01
125Sb	3.34E+01
126Sn	2.39E+00
129i	6.97E-01
134Cs	3.79E-01
137Cs	3.27E+05
137mBa	3.10E+05
151Sm	1.32E+04
152Eu	3.40E+00
154Eu	9.99E+02
155Eu	6.28E+02
226Ra	1.80E-04
227Ac	1.34E-03
228Ra	1.01E-01
229Th	2.76E-03
231Pa	4.94E-03
232Th	1.19E-02
232U	3.05E-01
233U	1.25E+00
234U	4.02E+00
235U	1.79E-01
236U	3.41E-02
237Np	1.31E+00
238Pu	1.48E+01
238U	4.03E+00
239Pu	5.37E+02
240Pu	9.10E+01
241Am	8.81E+02
241Pu	7.57E+02
242Cm	2.27E+00
242Pu	5.84E-03
243Am	3.13E-02
243Cm	1.84E-01
244Cm	1.62E+00

Table A-19. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-U-106 Decayed to January 1, 2001, Effective April 1, 2001. (2 sheets)

Analyte	Total Inventory (Ci)	Analyte	Total Inventory (Ci)
3H	6.93E+01	226Ra	9.89E-05
14C	1.92E+01	227Ac	6.14E-04
59Ni	1.65E+00	228Ra	2.98E-02
60Co	8.54E+01	229Th	7.76E-04
63Ni	1.54E+02	231Pa	2.75E-03
79Se	2.20E-01	232Th	2.90E-03
90Sr	6.34E+04	232U	6.32E-02
90Y	6.34E+04	233U	2.60E-01
93Zr	1.08E+01	234U	1.94E-01
93mNb	7.91E+00	235U	8.06E-03
99Tc	1.14E+02	236U	5.49E-03
106Ru	3.18E-05	237Np	4.23E-01
113mCd	3.90E+01	238Pu	1.03E+01
125Sb	1.75E+01	238U	1.82E-01
126Sn	1.33E+00	239Pu	3.63E+02
129i	2.20E-01	240Pu	6.20E+01
134Cs	1.18E-01	241Am	4.87E+02
137Cs	1.56E+05	241Pu	5.30E+02
137mBa	1.47E+05	242Cm	1.27E+00
151Sm	7.36E+03	242Pu	4.10E-03
152Eu	1.74E+00	243Am	1.80E-02
154Eu	7.61E+02	243Cm	1.03E-01
155Eu	3.87E+02	244Cm	9.28E-01

Table A-20. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-U-107 Decayed to January 1, 2001, Effective January 1, 2002. (2 sheets)

Analyte	Total Inventory (Ci)
3H	3.14E+02
14C	6.13E+01
59Ni	1.24E+00
60Co	1.61E+01
63Ni	1.16E+02
79Se	4.02E-01
90Sr	5.48E+03
90Y	5.48E+03
93Zr	1.97E+01
93mNb	1.60E+01
99Tc	5.35E+02
106Ru	6.15E-05
113mCd	7.32E+01
125Sb	3.43E+01
126Sn	2.43E+00
129i	1.03E+00
134Cs	5.30E-01
137Cs	2.46E+05
137mBa	2.33E+05
151Sm	1.34E+04
152Eu	3.43E+00
154Eu	9.12E+01
155Eu	2.31E+01

Analyte	Total Inventory (Ci)
226Ra	1.80E-04
227Ac	1.88E-03
228Ra	6.77E-02
229^{Th}	3.04E-03
231Pa	4.96E-03
232Th	1.37E-02
232U	3.32E-02
233U	1.36E-01
234U	3.31E-01
235U	1.40E-02
236U	7.64E-03
237Np	1.96E+00
238Pu	1.03E+01
238U	3.20E-01
239Pu	6.31E+02
240Pu	9.12E+01
241Am	1.05E+02
241Pu	4.51E+02
242Cm	2.50E-01
242Pu	2.87E-03
243Am	3.46E-03
243Cm	2.01E-02
244Cm	1.79E-01

Table A-21. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-U-108 Decayed to January 1, 2001, Effective January 1, 2001. (2 sheets)

Analyte	Total Inventory (Ci)
3H	2.76E+02
14C	6.02E+01
59Ni	3.14E+00
60Co	2.74E+01
63Ni	2.92E+02
79Se	5.42E-01
90Sr	1.96E+04
90Y	1.96E+04
93Zr	2.66E+01
93mNb	1.95E+01
99Tc	4.64E+02
106Ru	8.01E-05
113mCd	9.70E+01
125Sb	4.42E+01
126Sn	3.28E+00
129i	8.96E-01
134Cs	4.65E-01
137Cs	4.40E+05
137mBa	4.16E+05
151Sm	1.81E+04
152Eu	4.50E+00
154Eu	1.99E+02
155Eu	9.13E+01

Analyte	Total Inventory (Ci)
226Ra	2.43E-04
227Ac	1.50E-03
228Ra	1.10E-01
229Th	2.74E-03
231Pa	6.73E-03
232Th	1.15E-02
232U	5.27E-02
233U	2.15E-01
234U	6.31E+00
235U	2.40E-01
236U	4.09E-01
237Np	1.70E+00
238Pu	2.21E+01
238U	4.42E+00
239Pu	6.52E+02
240Pu	1.08E+02
241Am	1.76E+01
241Pu	6.90E+02
242Cm	4.43E-02
242Pu	2.62E-03
243Am	5.92E-04
243Cm	3.51E-03
244Cm	3.13E-02

Table A-22. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-U-109 Decayed to January 1, 2001, Effective October 1, 2001. (2 sheets)

Analyte	Total Inventory (Ci)	Analyte	Total Inventory (Ci)
3H	1.35E+02	226Ra	1.67E-04
14C	4.06E+01	227Ac	1.04E-03
59Ni	2.39E+00	228Ra	7.22E-02
60Co	1.54E+01	229Th	1.81E-03
63Ni	2.22E+02	231Pa	4.63E-03
79Se	3.73E-01	232Th	7.53E-03
90Sr	1.35E+04	232U	9.23E-03
90Y	1.35E+04	233U	3.78E-02
93Zr	1.83E+01	234U	9.89E-02
93mNb	1.34E+01	235U	4.37E-03
99Tc	2.26E+02	236U	1.08E-03
106Ru	5.50E-05	237Np	8.31E-01
113mCd	6.67E+01	238Pu	8.12E-01
125Sb	3.03E+01	238U	9.85E-02
126Sn	2.26E+00	239Pu	3.92E+01
129i	4.36E-01	240Pu	6.05E+00
134Cs	2.38E-01	241Am	2.09E+01
137Cs	2.13E+05	241Pu	3.84E+01
137mBa	2.02E+05	242Cm	5.40E-02
151Sm	1.25E+04	242Pu	2.73E-04
152Eu	3.03E+00	243Am	7.51E-04
154Eu	8.53E+02	243Cm	4.39E-03
155Eu	5.38E+02	244Cm	3.92E-02

Table A-23. Best–Basis Inventory Estimates for Radioactive Components in Tank 241-U-111 Decayed to January 1, 2001, Effective July 1, 2001. (2 sheets)

Analyte	Total Inventory (Ci)
3H	1.91E+02
14C	4.20E+01
59Ni	2.46E+00
60Co	2.85E+01
63Ni	2.26E+02
79Se	3.41E-01
90Sr	5.63E+04
90Y	5.63E+04
93Zr	1.67E+01
93mNb	1.23E+01
99Tc	3.23E+02
106Ru	5.05E-05
113mCd	6.12E+01
125Sb	2.80E+01
126Sn	2.06E+00
129i	6.21E-01
134Cs	3.21E-01
137Cs	3.10E+05
137mBa	2.93E+05
151Sm	1.14E+04
152Eu	3.03E+00
154Eu	7.21E+02
155Eu	4.59E+02

Analyte	Total Inventory (Ci)
226Ra	2.06E-04
227Ac	1.14E-03
228Ra	7.85E-02
229Th	1.94E-03
231Pa	4.23E-03
232Th	8.40E-03
232U	9.12E-02
233U	3.74E-01
234U	4.12E-01
235U	1.75E-02
236U	8.71E-03
237Np	1.18E+00
238Pu	4.86E+00
238U	4.02E-01
239Pu	2.29E+02
240Pu	3.54E+01
241Am	1.83E+02
241Pu	2.41E+02
242Cm	3.35E-02
242Pu	1.78E-03
243Am	5.82E-03
243Cm	8.39E-04
244Cm	3.30E-03

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APPENDIX B

EMISSION AND DOSE CALCULATIONS–SALTWELL PUMPING UNDER PASSIVE VENTILATION

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APPENDIX B

EMISSION AND DOSE CALCULATIONS–SALTWELL PUMPING UNDER PASSIVE VENTILATION

Table B-1. Salt Well Pumping-Passive Ventilation. (2 sheets)

Ventilation Flow Rate 0.28 Meter^3/Min		
Breather HEPA Emission Adjustment Factor 1.00% Per 40 CFR 61 APP D		
Dose Conversion mrem/Curie		
	200-East	**200-West**
TOTAL ALPHA (Am-241)	1.50E+01	1.70E+01
TOTAL BETA (Sr-90) + daughters	9.50E-03	1.10E-02
Cs-137 + daughters	2.70E-01	3.10E-01

Tank	**Location**	**Total Alpha pCi /Liter**	**Total Beta pCi /Liter**	**Cs-137 pCi/Liter**	**Unabated Alpha Per Year, Ci**	**Unabated Beta Per Year, Ci**	**Unabated Cs-137 Per Year, Ci**	**Unabated Dose Alpha Per Year, mrem**	**Unabated Dose Beta Per Year, mrem**	**Unabated Dose Cs-137 Per Year, mrem**	**Total Unabated Per Year, mrem**	**Abated Dose Alpha Per Year, mrem**	**Abated Dose Beta Per Year, mrem**	**Abated Dose Cs-137 Per Year, mrem**	**Total Abated Dose Per Year, mrem**
241-A-101	200-East	0.18	0.93	0.1	2.65E-05	1.37E-04	1.47E-05	3.97E-04	1.30E-06	3.97E-06	**4.03E-04**	3.97E-06	1.30E-08	3.97E-08	**4.03E-06**
241-AX-101	200-East	0.24	1.08	0.1	3.53E-05	1.59E-04	1.47E-05	5.30E-04	1.51E-06	3.97E-06	**5.35E-04**	5.30E-06	1.51E-08	3.97E-08	**5.35E-06**
241-BY-105	200-East	0.002	0.016	0.1	2.94E-07	2.35E-06	1.47E-05	4.42E-06	2.24E-08	3.97E-06	**8.41E-06**	4.42E-08	2.24E-10	3.97E-08	**8.41E-08**
241-BY-106	200-East	0.01	0.04	0.1	1.47E-06	5.89E-06	1.47E-05	2.21E-05	5.59E-08	3.97E-06	**2.61E-05**	2.21E-07	5.59E-10	3.97E-08	**2.61E-07**
241-C-103	200-East	6.4	10.1	0.1	9.42E-04	1.49E-03	1.47E-05	1.41E-02	1.41E-05	3.97E-06	**1.41E-02**	1.41E-04	1.41E-07	3.97E-08	**1.41E-04**
241-S-101	200-West	0.157	1.67	26.9	2.31E-05	2.46E-04	3.96E-03	3.93E-04	2.70E-06	1.23E-03	**1.62E-03**	3.93E-06	2.70E-08	1.23E-05	**1.62E-05**
241-S-102	200-West	0.59	2.96	3.89	8.68E-05	4.36E-04	5.72E-04	1.48E-03	4.79E-06	1.77E-04	**1.66E-03**	1.48E-05	4.79E-08	1.77E-06	**1.66E-05**
241-S-103	200-West	0.86	6.17	24.8	1.27E-04	9.08E-04	3.65E-03	2.15E-03	9.99E-06	1.13E-03	**3.29E-03**	2.15E-05	9.99E-08	1.13E-05	**3.29E-05**
241-S-106	200-West	0.609	2.06	18	8.96E-05	3.03E-04	2.65E-03	1.52E-03	3.33E-06	8.21E-04	**2.35E-03**	1.52E-05	3.33E-08	8.21E-06	**2.35E-05**
241-S-107	200-West	2.91	2.63	31.8	4.28E-04	3.87E-04	4.68E-03	7.28E-03	4.26E-06	1.45E-03	**8.74E-03**	7.28E-05	4.26E-08	1.45E-05	**8.74E-05**
241-S-109	200-West	2.69	7.16	26.9	3.96E-04	1.05E-03	3.96E-03	6.73E-03	1.16E-05	1.23E-03	**7.97E-03**	6.73E-05	1.16E-07	1.23E-05	**7.97E-05**
241-S-111	200-West	0.52	0.82	0.1	7.65E-05	1.21E-04	1.47E-05	1.30E-03	1.33E-06	4.56E-06	**1.31E-03**	1.30E-05	1.33E-08	4.56E-08	**1.31E-05**
241-S-112	200-West	12	13.2	0.1	1.77E-03	1.94E-03	1.47E-05	3.00E-02	2.14E-05	4.56E-06	**3.00E-02**	3.00E-04	2.14E-07	4.56E-08	**3.00E-04**
241-T-104	200-West	0.07	0.32	0.1	1.03E-05	4.71E-05	1.47E-05	1.75E-04	5.18E-07	4.56E-06	**1.80E-04**	1.75E-06	5.18E-09	4.56E-08	**1.80E-06**
241-T-110	200-West	0.06	0.09	0.1	8.83E-06	1.32E-05	1.47E-05	1.50E-04	1.46E-07	4.56E-06	**1.55E-04**	1.50E-06	1.46E-09	4.56E-08	**1.55E-06**
241-U-102	200-West	0.07	0.18	0.04	1.03E-05	2.65E-05	5.89E-06	1.75E-04	2.91E-07	1.82E-06	**1.77E-04**	1.75E-06	2.91E-09	1.82E-08	**1.77E-06**
241-U-103	200-West	0.21	0.01	0.1	3.09E-05	1.47E-06	1.47E-05	5.25E-04	1.62E-08	4.56E-06	**5.30E-04**	5.25E-06	1.62E-10	4.56E-08	**5.30E-06**
241-U-105	200-West	0.02	0.09	0.1	2.94E-06	1.32E-05	1.47E-05	5.00E-05	1.46E-07	4.56E-06	**5.47E-05**	5.00E-07	1.46E-09	4.56E-08	**5.47E-07**
241-U-106	200-West	0.15	0.72	0.1	2.21E-05	1.06E-04	1.47E-05	3.75E-04	1.17E-06	4.56E-06	**3.81E-04**	3.75E-06	1.17E-08	4.56E-08	**3.81E-06**

Table B-1. Salt Well Pumping-Passive Ventilation. (2 sheets)

Ventilation Flow Rate 0.28 Meter^3/Min		
Breather HEPA Emission Adjustment Factor 1.00% Per 40 CFR 61 APP D		
Dose Conversion mrem/Curie		
	200-East	**200-West**
TOTAL ALPHA (Am-241)	1.50E+01	1.70E+01
TOTAL BETA (Sr-90) + daughters	9.50E-03	1.10E-02
Cs-137 + daughters	2.70E-01	3.10E-01

					Unabated	Unabated	Unabated	Unabated Dose	Unabated Dose	Unabated Dose		Abated Dose	Abated Dose	Abated Dose	
Tank	**Location**	**Total Alpha pCi /Liter**	**Total Beta pCi /Liter**	**Cs-137 pCi/Liter**	**Alpha Per Year, Ci**	**Beta Per Year, Ci**	**Cs-137 Per Year, Ci**	**Alpha Per Year, mrem**	**Beta Per Year, mrem**	**Cs-137 Per Year, mrem**	**Total Unabated Per Year, mrem**	**Alpha Per Year, mrem**	**Beta Per Year, mrem**	**Cs-137 Per Year, mrem**	**Total Abated Dose Per Year, mrem**
241-U-107	200-West	0.004	0.06	0.1	5.89E-07	8.83E-06	1.47E-05	1.00E-05	9.71E-08	4.56E-06	1.47E-05	1.00E-07	9.71E-10	4.56E-08	1.47E-07
241-U-108	200-West	0.03	0.16	0.1	4.42E-06	2.35E-05	1.47E-05	7.51E-05	2.59E-07	4.56E-06	7.99E-05	7.51E-07	2.59E-09	4.56E-08	7.99E-07
241-U-109	200-West	0.22	0.31	0.1	3.24E-05	4.56E-05	1.47E-05	5.50E-04	5.02E-07	4.56E-06	5.55E-04	5.50E-06	5.02E-09	4.56E-08	5.55E-06
241-U-111	200-West	0.05	0.21	0.1	7.36E-06	3.09E-05	1.47E-05	1.25E-04	3.40E-07	4.56E-06	1.30E-04	1.25E-06	3.40E-09	4.56E-08	1.30E-06
TOTALS											7.44E-02				7.44E-04

NOTE 1: Dose conversion factors are from "Calculating Potential-to-Emit Releases and Doses for FEMPS and NOCs, HNF-3602 Revision 1, January 2002

NOTE 2: Vapor Space data updated for 23 SSTs per PNNL letter D. Sklarew (PNL) to G. Wells (CHG), August 27, 2001

APPENDIX C

EMISSION AND DOSE CALCULATIONS–SALTWELL PUMPING UNDER ACTIVE VENTILATION

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APPENDIX C

EMISSION AND DOSE CALCULATIONS–SALTWELL PUMPING UNDER ACTIVE VENTILATION

Table C-1. Salt Well Pumping-Active Ventilation. (2 sheets)

Ventilation Flow Rate 34 Meter^3/Min		
# HEPA Filters In Series 2 Credit is taken for 1 HEPA		
HEPA Filter Efficiency 99.95%		
Dose Conversion mrem/Curie		
	200-East	**200-West**
TOTAL ALPHA (Am-241)	1.50E+01	1.70E+01
TOTAL BETA (Sr-90) + daughters	9.50E-03	1.10E-02
Cs-137 + daughters	2.70E-01	3.10E-01

					Unabated	**Unabated**	**Unabated**	**Unabated Dose**	**Unabated Dose**	**Unabated Dose**		**Abated Dose**	**Abated Dose**	**Abated Dose**	
Tank	**Location**	**Total Alpha pCi/Liter**	**Total BETA pCi/Liter**	**Cs-137 pCi/Liter**	**Alpha Per Year, Ci**	**Beta Per Year, Ci**	**Cs-137 Per Year, Ci**	**Alpha Per Year, mrem**	**Beta Per Year, mrem**	**Cs-137 Per Year, mrem**	**Total Unabated Per Year, mrem**	**Alpha Per Year, mrem**	**Beta Per Year, mrem**	**Cs-137 Per Year, mrem**	**Total Abated Per Year, mrem**
241-A-101	200-East	0.18	0.93	0.1	3.22E-03	1.66E-02	1.79E-03	4.83E-02	1.58E-04	4.83E-04	**4.89E-02**	2.41E-05	7.89E-08	2.41E-07	**2.44E-05**
241-AX-101	200-East	0.24	1.08	0.1	4.29E-03	1.93E-02	1.79E-03	6.43E-02	1.83E-04	4.83E-04	**6.50E-02**	3.22E-05	9.17E-08	2.41E-07	**3.25E-05**
241-BY-105	200-East	0.002	0.016	0.1	3.57E-05	2.86E-04	1.79E-03	5.36E-04	2.72E-06	4.83E-04	**1.02E-03**	2.68E-07	1.36E-09	2.41E-07	**5.11E-07**
241-BY-106	200-East	0.01	0.04	0.1	1.79E-04	7.15E-04	1.79E-03	2.68E-03	6.79E-06	4.83E-04	**3.17E-03**	1.34E-06	3.40E-09	2.41E-07	**1.58E-06**
241-C-103	200-East	6.4	10.1	0.1	1.14E-01	1.80E-01	1.79E-03	1.72E+00	1.71E-03	4.83E-04	**1.72E+00**	8.58E-04	8.57E-07	2.41E-07	**8.59E-04**
241-S-101	200-West	0.157	1.67	26.9	2.81E-03	2.98E-02	4.81E-01	4.77E-02	3.28E-04	1.49E-01	**1.97E-01**	2.38E-05	1.64E-07	7.45E-05	**9.85E-05**
241-S-102	200-West	0.59	2.96	3.89	1.05E-02	5.29E-02	6.95E-02	1.79E-01	5.82E-04	2.15E-02	**2.01E-01**	8.96E-05	2.91E-07	1.08E-05	**1.01E-04**
241-S-103	200-West	0.86	6.17	24.8	1.54E-02	1.10E-01	4.43E-01	2.61E-01	1.21E-03	1.37E-01	**4.00E-01**	1.31E-04	6.06E-07	6.87E-05	**2.00E-04**
241-S-106	200-West	0.609	2.06	18	1.09E-02	3.68E-02	3.22E-01	1.85E-01	4.05E-04	9.97E-02	**2.85E-01**	9.25E-05	2.02E-07	4.99E-05	**1.43E-04**
241-S-107	200-West	2.91	2.63	31.8	5.20E-02	4.70E-02	5.68E-01	8.84E-01	5.17E-04	1.76E-01	**1.06E+00**	4.42E-04	2.58E-07	8.81E-05	**5.30E-04**
241-S-109	200-West	2.69	7.16	26.9	4.81E-02	1.28E-01	4.81E-01	8.17E-01	1.41E-03	1.49E-01	**9.68E-01**	4.09E-04	7.04E-07	7.45E-05	**4.84E-04**
241-S-111	200-West	0.52	0.82	0.1	9.29E-03	1.47E-02	1.79E-03	1.58E-01	1.61E-04	5.54E-04	**1.59E-01**	7.90E-05	8.06E-08	2.77E-07	**7.93E-05**
241-S-112	200-West	12	13.2	0.1	2.14E-01	2.36E-01	1.79E-03	3.65E+00	2.59E-03	5.54E-04	**3.65E+00**	1.82E-03	1.30E-06	2.77E-07	**1.82E-03**
241-T-104	200-West	0.07	0.32	0.1	1.25E-03	5.72E-03	1.79E-03	2.13E-02	6.29E-05	5.54E-04	**2.19E-02**	1.06E-05	3.15E-08	2.77E-07	**1.09E-05**
241-T-110	200-West	0.06	0.09	0.1	1.07E-03	1.61E-03	1.79E-03	1.82E-02	1.77E-05	5.54E-04	**1.88E-02**	9.11E-06	8.85E-09	2.77E-07	**9.40E-06**
241-U-102	200-West	0.07	0.18	0.04	1.25E-03	3.22E-03	7.15E-04	2.13E-02	3.54E-05	2.22E-04	**2.15E-02**	1.06E-05	1.77E-08	1.11E-07	**1.08E-05**
241-U-103	200-West	0.21	0.01	0.1	3.75E-03	1.79E-04	1.79E-03	6.38E-02	1.97E-06	5.54E-04	**6.44E-02**	3.19E-05	9.83E-10	2.77E-07	**3.22E-05**

Table C-1. Salt Well Pumping-Active Ventilation. (2 sheets)

Ventilation Flow Rate 34 Meter^3/Min		
# HEPA Filters In Series 2 Credit is taken for 1 HEPA		
HEPA Filter Efficiency 99.95%		
Dose Conversion mrem/Curie		
	200-East	**200-West**
TOTAL ALPHA (Am-241)	1.50E+01	1.70E+01
TOTAL BETA (Sr-90) + daughters	9.50E-03	1.10E-02
Cs-137 + daughters	2.70E-01	3.10E-01

					Unabated	**Unabated**	**Unabated**	**Unabated Dose**	**Unabated Dose**	**Unabated Dose**		**Abated Dose**	**Abated Dose**	**Abated Dose**	
Tank	**Location**	**Total Alpha pCi/Liter**	**Total BETA pCi/Liter**	**Cs-137 pCi/Liter**	**Alpha Per Year, Ci**	**Beta Per Year, Ci**	**Cs-137 Per Year, Ci**	**Alpha Per Year, mrem**	**Beta Per Year, mrem**	**Cs-137 Per Year, mrem**	**Total Unabated Per Year, mrem**	**Alpha Per Year, mrem**	**Beta Per Year, mrem**	**Cs-137 Per Year, mrem**	**Total Abated Per Year, mrem**
241-U-105	200-West	0.02	0.09	0.1	3.57E-04	1.61E-03	1.79E-03	6.08E-03	1.77E-05	5.54E-04	**6.65E-03**	3.04E-06	8.85E-09	2.77E-07	**3.32E-06**
241-U-106	200-West	0.15	0.72	0.1	2.68E-03	1.29E-02	1.79E-03	4.56E-02	1.42E-04	5.54E-04	**4.63E-02**	2.28E-05	7.08E-08	2.77E-07	**2.31E-05**
241-U-107	200-West	0.004	0.06	0.1	7.15E-05	1.07E-03	1.79E-03	1.22E-03	1.18E-05	5.54E-04	**1.78E-03**	6.08E-07	5.90E-09	2.77E-07	**8.90E-07**
241-U-108	200-West	0.03	0.16	0.1	5.36E-04	2.86E-03	1.79E-03	9.11E-03	3.15E-05	5.54E-04	**9.70E-03**	4.56E-06	1.57E-08	2.77E-07	**4.85E-06**
241-U-109	200-West	0.22	0.31	0.1	3.93E-03	5.54E-03	1.79E-03	6.68E-02	6.09E-05	5.54E-04	**6.75E-02**	3.34E-05	3.05E-08	2.77E-07	**3.37E-05**
241-U-111	200-West	0.05	0.21	0.1	8.94E-04	3.75E-03	1.79E-03	1.52E-02	4.13E-05	5.54E-04	**1.58E-02**	7.59E-06	2.06E-08	2.77E-07	**7.89E-06**
TOTALS											**9.03E+00**				**4.51E-03**

NOTE 1: Dose conversion factors are from "Calculating Potential-to-Emit Releases and Doses for FEMPS and NOCs, HNF-3602 Revision 1, January 2002

NOTE 2: Vapor Space data updated for 23 SSTs per PNNL letter D. Sklarew (PNL) to G. Wells (CHG), August 27, 2001

APPENDIX D

EMISSION AND DOSE CALCULATIONS-WATER LANCING

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APPENDIX D

EMISSION AND DOSE CALCULATIONS-WATER LANCING

Table D-1. Water Lansing-Passive Ventilation-Administratively Controlled to 72 Hours Maximum Operation In Each Tank. (2 sheets)

Ventilation Flow Rate	0.28 Meter^3/Min	
Breather HEPA Emission Adjustment Factor 1.00% Per 40 CFR 61 APP D		
Dose Conversion Mrem/Curie		
	200-East	**200-West**
TOTAL ALPHA (Am-241)	1.50E+01	1.70E+01
TOTAL BETA (Sr-90)	9.50E-03	1.10E-02
Cs-137	2.70E-01	3.10E-01

Tank	Location	Total Alpha pCi/Liter	Total Beta pCi/Liter	Cs-137 pCi/Liter	Unabated Emissions Alpha Per Year, Ci	Unabated Emissions Beta Per Year, Ci	Unabated Emissions Cs-137 Per Year, Ci	Unabated Dose Alpha Per Year, Mrem	Unabated Dose Beta Per Year, mrem	Unabated Dose Cs-137 Per Year, mrem	Total Unabated Per Year, mrem	10x Unabated Per Year, mrem*	10x Total Abated Per Year,mrem
241-A-101	200-East	0.18	0.93	0.1	2.18E-07	1.12E-06	1.21E-07	3.27E-06	1.07E-08	3.27E-08	3.31E-06	**3.31E-05**	**3.31E-07**
241-AX-101	200-East	0.24	1.08	0.1	2.90E-07	1.31E-06	1.21E-07	4.35E-06	1.24E-08	3.27E-08	4.40E-06	**4.40E-05**	**4.40E-07**
241-BY-105	200-East	0.002	0.016	0.1	2.42E-09	1.94E-08	1.21E-07	3.63E-08	1.84E-10	3.27E-08	6.91E-08	**6.91E-07**	**6.91E-09**
241-BY-106	200-East	0.01	0.04	0.1	1.21E-08	4.84E-08	1.21E-07	1.81E-07	4.60E-10	3.27E-08	2.15E-07	**2.15E-06**	**2.15E-08**
241-C-103	200-East	6.4	10.1	0.1	7.74E-06	1.22E-05	1.21E-07	1.16E-04	1.16E-07	3.27E-08	1.16E-04	**1.16E-03**	**1.16E-05**
241-S-101	200-West	0.157	1.67	26.9	1.90E-07	2.02E-06	3.25E-05	3.23E-06	2.22E-08	1.01E-05	1.33E-05	**1.33E-04**	**1.33E-06**
241-S-102	200-West	0.59	2.96	3.89	7.14E-07	3.58E-06	4.71E-06	1.21E-05	3.94E-08	1.46E-06	1.36E-05	**1.36E-04**	**1.36E-06**
241-S-103	200-West	0.86	6.17	24.8	1.04E-06	7.46E-06	3.00E-05	1.77E-05	8.21E-08	9.30E-06	2.71E-05	**2.71E-04**	**2.71E-06**
241-S-106	200-West	0.609	2.06	18	7.37E-07	2.49E-06	2.18E-05	1.25E-05	2.74E-08	6.75E-06	1.93E-05	**1.93E-04**	**1.93E-06**
241-S-107	200-West	2.91	2.63	31.8	3.52E-06	3.18E-06	3.85E-05	5.98E-05	3.50E-08	1.19E-05	7.18E-05	**7.18E-04**	**7.18E-06**
241-S-109	200-West	2.69	7.16	26.9	3.25E-06	8.66E-06	3.25E-05	5.53E-05	9.53E-08	1.01E-05	6.55E-05	**6.55E-04**	**6.55E-06**
241-S-111	200-West	0.52	0.82	0.1	6.29E-07	9.92E-07	1.21E-07	1.07E-05	1.09E-08	3.75E-08	1.07E-05	**1.07E-04**	**1.07E-06**
241-S-112	200-West	12	13.2	0.1	1.45E-05	1.60E-05	1.21E-07	2.47E-04	1.76E-07	3.75E-08	2.47E-04	**2.47E-03**	**2.47E-05**
241-T-104	200-West	0.07	0.32	0.1	8.47E-08	3.87E-07	1.21E-07	1.44E-06	4.26E-09	3.75E-08	1.48E-06	**1.48E-05**	**1.48E-07**
241-T-110	200-West	0.06	0.09	0.1	7.26E-08	1.09E-07	1.21E-07	1.23E-06	1.20E-09	3.75E-08	1.27E-06	**1.27E-05**	**1.27E-07**
241-U-102	200-West	0.07	0.18	0.04	8.47E-08	2.18E-07	4.84E-08	1.44E-06	2.40E-09	1.50E-08	1.46E-06	**1.46E-05**	**1.46E-07**
241-U-103	200-West	0.21	0.01	0.1	2.54E-07	1.21E-08	1.21E-07	4.32E-06	1.33E-10	3.75E-08	4.36E-06	**4.36E-05**	**4.36E-07**
241-U-105	200-West	0.02	0.09	0.1	2.42E-08	1.09E-07	1.21E-07	4.11E-07	1.20E-09	3.75E-08	4.50E-07	**4.50E-06**	**4.50E-08**
241-U-106	200-West	0.15	0.72	0.1	1.81E-07	8.71E-07	1.21E-07	3.08E-06	9.58E-09	3.75E-08	3.13E-06	**3.13E-05**	**3.13E-07**

Table D-1. Water Lansing-Passive Ventilation-Administratively Controlled to 72 Hours Maximum Operation In Each Tank. (2 sheets)

Ventilation Flow Rate	0.28 Meter^3/Min	
Breather HEPA Emission Adjustment Factor	1.00% Per 40 CFR 61 APP D	
Dose Conversion Mrem/Curie		
	200-East	**200-West**
TOTAL ALPHA (Am-241)	1.50E+01	1.70E+01
TOTAL BETA (Sr-90)	9.50E-03	1.10E-02
Cs-137	2.70E-01	3.10E-01

					Unabated Emissions	Unabated Emissions	Unabated Emissions	Unabated Dose	Unabated Dose	Unabated Dose			
Tank	**Location**	**Total Alpha pCi/Liter**	**Total Beta pCi/Liter**	**Cs-137 pCi/Liter**	**Alpha Per Year, Ci**	**Beta Per Year, Ci**	**Cs-137 Per Year, Ci**	**Alpha Per Year, Mrem**	**Beta Per Year, mrem**	**Cs-137 Per Year, mrem**	**Total Unabated Per Year, mrem**	**10x Unabated Per Year, mrem***	**10x Total Abated Per Year.mrem**
241-U-107	200-West	0.004	0.06	0.1	4.84E-09	7.26E-08	1.21E-07	8.23E-08	7.98E-10	3.75E-08	1.21E-07	**1.21E-06**	**1.21E-08**
241-U-108	200-West	0.03	0.16	0.1	3.63E-08	1.94E-07	1.21E-07	6.17E-07	2.13E-09	3.75E-08	6.57E-07	**6.57E-06**	**6.57E-08**
241-U-109	200-West	0.22	0.31	0.1	2.66E-07	3.75E-07	1.21E-07	4.52E-06	4.12E-09	3.75E-08	4.57E-06	**4.57E-05**	**4.57E-07**
241-U-111	200-West	0.05	0.21	0.1	6.05E-08	2.54E-07	1.21E-07	1.03E-06	2.79E-09	3.75E-08	1.07E-06	**1.07E-05**	**1.07E-07**
TOTALS												**6.11E-03**	**6.11E-05**

*The total dose is multiplied by a factor of 10 to account for uncertainity regarding a potential increase in vapor space rad concentration due to use of water lance in the waste (see Section 10.1).

NOTE 1: Dose conversion factors are from "Calculating Potential-to-Emit Releases and Doses for FEMPS and NOCs, HNF-3602 Revision 1, January 2002

NOTE 2: Vapor Space data updated for 23 SSTs per PNNL letter D. Sklarew (PNL) to G. Wells (CHG), August 27, 2001

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